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Environment Canada Environnement Canada

CANADIAN RESEARCH CATALOGUE

ON THE

LRTAP

ACTIVITÉS DE RECHERCHE AU CANADA

SUR LE

TGDPA

1983

Canada

Environment Canada Environnement Canada

THE CANADIAN RESEARCH ACTIVITY CATALOGUE

ON

THE LONG-RANGE TRANSPORT OF AIR POLLUTANTS

AND ACIDIC PRECIPITATION

CATALOGUE DES ACTIVITÉS DE RECHERCHE AU CANADA

SUR

LE TRANSPORT À GRANDE DISTANCE DES POLLUANTS ATMOSPHÉRIQUES ET LES PRÉCIPITATIONS ACIDES

Canada

FEBRUARY/FÉVRIER

1983

Federal LRTAP Liaison Office
Atmospheric Environment Service
4905 Dufferin Street
Downsview, Ontario
M3H 5T4

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Service de l'environnement atmosphérique
Environnement Canada
4905, rue Dufferin
Downsview (Ontario)
M3H 5T4

FOREWORD

In an effort to foster coordinated research programs on the long-range transport of air pollutants (LRTAP) and 'acid rain' within the Canadian scientific community, a catalogue of research projects was prepared in February of 1981. At the August 3, 1982 meeting of the Federal/ Provincial LRTAP-Acid Rain Research and Monitoring Coordinating Committee (RMCC), it was agreed that the catalogue should be updated. The two years which have passed since the catalogue was first produced have been marked by an increase in scientific activity and a redirection of effort in some areas. During this time, the federal and provincial research programs have become more fully coordinated and mechanisms have been put into place to ensure coordination with the research programs in the United States. The academic and private sectors have also been active in this research effort.

This research catalogue update contains descriptions of 439 research projects. The projects have been numbered and are listed according to subject as indicated in the table of contents. An author index is included at the end of the catalogue. This catalogue is a compilation of the responses to questionnaires completed by program coordinators and project managers from the federal and provincial governments, academic institutions and industry. I would like to take this opportunity to thank each of the reporting individuals for their cooperation. Their participation in a timely manner has insured the value of this compilation.

H. C. Martin
LRTAP Liaison Office
February, 1983

AVANT-PROPOS

En vue d'encourager la réalisation de programmes coordonnés de recherche sur le transport à grande distance de polluants atmosphériques (TGDPA) et sur la "pluie acide", on a dressé en février 1981 le catalogue des projets de recherche. A la réunion qu'a tenue, le 3 août 1982, le Comité fédéral- provincial de coordination de la recherche et de la surveillance dans le domaine du TGDPA et des pluies acides (CCRS), on avait convenu qu'il fallait mettre le catalogue à jour. Les deux années écoulées depuis la création du premier catalogue furent marquées par l'accroissement de l'activité scientifique et une réorientation des efforts déployés dans certains domaines. Pendant ce temps, on coordonna de plus en plus les programmes de recherche fédéraux et provinciaux et on établit des mécanismes permettant d'assurer la coordination avec les programmes de recherche des États-Unis. Le secteur universitaire et le secteur privé jouèrent aussi un rôle actif dans ce domaine de recherche.

Cette mise à jour du catalogue de recherche contient la description de 439 projets de recherche, qu'on a numérotés puis énumérés par sujet, selon les indications de la table des matières. Un répertoire des auteurs figure à la fin du catalogue. Cet ouvrage repose sur les réponses fournies aux questionnaires remplis par les coordonnateurs de programme et les chefs de projet du gouvernement fédéral et des gouvernements provinciaux, des établissements universitaires et de l'industrie. J'aimerais profiter de l'occasion pour remercier de leur collaboration les personnes qui nous ont fait parvenir leurs réponses. Ce recueil de données doit sa valeur à leur précieux concours.

H.C. Martin
Bureau de liaison du PETGDPA
Février 1983

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SECTION 1

EMISSIONS

SUBJECT CODE: 1.1

PROJECT NUMBER: 1

TITLE: Alberta Sulphur Dioxide Emission Forecast (1980-2000)

PRINCIPAL INVESTIGATOR'S NAME: Dr. Harby S. Sandhu

AGENCY AND DEPARTMENT: Research Management Division, Alberta Environment

ADDRESS: 14th Floor, Standard Life Centre
10405 Jasper Avenue
Edmonton, Alberta
T5J 3N4

PHONE: (403) 427-3943

COOPERATING AGENCIES AND INVESTIGATORS: This work is contracted out to Western Research and Development: 1313-44th Avenue N.E., Calgary, Alberta T2E 6L5

DURATION OF EACH PHASE:

APPROXIMATE COST: $45,000 (82-83)

OBJECTIVES: Two industrial growth scenarios (high vs conservative growth) are outlined then used to prepare sulphur dioxide emission forecasts. The forecasts consider separately the application of present, best practicable and best available technology to either recover sulphur as a product or control sulphur dioxide emissions. Recommendations respecting management strategies and monitoring of key indicators were developed for consideration.

METHOD: Contact the principal investigator for project methodology.

ANTICIPATED RESULTS: An interim report is available from the Research Management Division, Alberta Environment.

PROJECT NUMBER: 2

SUBJECT CODE: 1.1

TITLE: Industrial Sulphur Emissions for Alberta 1977-1981

PRINCIPAL INVESTIGATOR'S NAME: David Onuczko

AGENCY AND DEPARTMENT: Pollution Control Division, Alberta Environment

ADDRESS: 6th Floor, Oxbridge Place
9820 - 106 Street
Edmonton, Alberta
T5K 2J6

PHONE: (403) 427-5893

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE:

APPROXIMATE COST:

OBJECTIVES: The sulphur dioxide emissions inventory for industrial sources in Alberta has been updated. The observed and licenced contributions are given for individual plants and industrial groups. Trends in the emission totals are also included.

METHOD: Contact the principal investigator for project methodology.

ANTICIPATED RESULTS: A final report is available from the Pollution Control Division, Alberta Environment.

SUBJECT CODE: 1.1

PROJECT NUMBER: 3

TITLE: Alberta Nitrogen Oxides Emissions Forecast (1980-2000)

PRINCIPAL INVESTIGATOR'S NAME: Ms. B. Magill

AGENCY AND DEPARTMENT: Research Management Division, Alberta Environment

ADDRESS: 14th Floor, Standard Life Centre
10405 Jasper Avenue
Edmonton, Alberta
T5J 3N4

PHONE: (403) 427-3943

COOPERATING AGENCIES AND INVESTIGATORS: Work contracted out to Western Research and Development, 1331 - 44th Avenue N.E., Calgary, Alberta T2E 6L5

DURATION OF EACH PHASE: Commenced 1982

APPROXIMATE COST: $75,000 (82-83)

OBJECTIVES: The study is designed to develop a forecast of nitrogen oxides emissions for each of the energy related industries in Alberta that emit NO_x. The investigation includes a review of both current and developing technology for emission control.

METHOD: Contact principal investigator for project methodologies.

ANTICIPATED RESULTS: A final report will be available in early 1983 from the Research Management Division, Alberta Environment.

PROJECT NUMBER: 4

SUBJECT CODE: 1.1

TITLE: Industrial NO_X Emissions for Alberta 1977-1981

PRINCIPAL INVESTIGATOR'S NAME: David Onuczko

AGENCY AND DEPARTMENT: Pollution Control Division, Alberta Environment

ADDRESS: 6th Floor, Oxbridge Place
9820 - 106 Street
Edmonton, Alberta
T5K 2J6

PHONE: (403) 427-5893

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE:

APPROXIMATE COST:

OBJECTIVES: An inventory of NO_X emission sources in Alberta will be given. Emission totals, both observed and licenced, for individual plants and industrial groups are included along with observed trends.

METHOD: Contact the principal investigator for project methodology.

ANTICIPATED RESULTS: A final report will be available mid 1983 from the Pollution Control Division, Alberta Environment.

SUBJECT CODE: 1.1

PROJECT NUMBER: 5

TITLE: SO_X and NO_X Emissions Inventory for Saskatchewan, 1981

PRINCIPAL INVESTIGATOR'S NAME: Mr. L. Lechner

AGENCY AND DEPARTMENT: Saskatchewan Environment

ADDRESS: 5th Floor
1855 Victoria Avenue
Regina, Saskatchewan
S4P 3V5

PHONE: (306) 565-6195

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: 3 months - June to August, 1982

APPROXIMATE COST: $5,000

OBJECTIVES: Prepare an inventory on anthropogenic sources and emissions of sulphur and nitrogen oxides.

METHOD:
a) Questionnaires (in-house) for any available information
b) Personal communications
c) Emission factors

ANTICIPATED RESULTS: A report will be published upon completion of the work.

PROJECT NUMBER: 6

SUBJECT CODE: 1.1

TITLE: Emissions Monitoring - In Stack

PRINCIPAL INVESTIGATOR'S NAME: W. W. Fraser, Director Safety and Environment

AGENCY AND DEPARTMENT: Hudson Bay Mining and Smelting, Process Technology Dept.

ADDRESS: P.O. Box 1500
Flin Flon, Manitoba

PHONE: (204) 687-5221

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: Ongoing

APPROXIMATE COST: $50,000/year

OBJECTIVES:

a) Collect data for metallurgical accounting and emissions control assessments.

b) Provide testing as required under Manitoba Clean Environment Commission Order 899V0.

METHOD: Standard reference methods for measurement of particulate and SO_2 emission, in stack.

ANTICIPATED RESULTS:

SUBJECT CODE: 1.1

PROJECT NUMBER: 7

TITLE: Gridded SO_2 Emission Inventory

PRINCIPAL INVESTIGATOR'S NAME: F. Vena
Chief, Pollution Data Analysis Division

AGENCY AND DEPARTMENT: Environment Canada, EPS, Air Pollution Control Directorate

ADDRESS: Place Vincent Massey
Ottawa, Ontario
K1A 1C8

PHONE: (819) 997-3352

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: Ongoing in-house.

APPROXIMATE COST: Salary only.

OBJECTIVES: To prepare an updated (1978-80) SO_2 emissions inventory for Canada on a 127km grid basis as required by the modelling component of the LRTAP program.

METHOD: a) Point sources (large commercial/industrial establishments) are located within each specific grid cell (lat.-long. coordinates).

b) Area sources within each specific grid cell are agglomerated and presented as total SO_2 emissions from each grid cell.

ANTICIPATED RESULTS: Canadian SO_2 emissions inventory (1978-80 data) on a 127km by 127km grid, in computer compatible format.

PROJECT NUMBER: 8

SUBJECT CODE: I.1

TITLE: Inventory of SO_2 Emissions (1950 - 2000)

PRINCIPAL INVESTIGATOR'S NAME: Frank Vena
Chief, Pollution Data Analysis Division

AGENCY AND DEPARTMENT: Environment Canada, EPS, Air Pollution Control Directorate

ADDRESS: Place Vincent Massey
Ottawa, Ontario
K1A 1C8

PHONE: (819) 997-3352

COOPERATING AGENCIES AND INVESTIGATORS.

DURATION OF EACH PHASE:

APPROXIMATE COST: 03/80 - 08/80 (Salary only)

OBJECTIVES: To provide an insight into levels of SO_2 emissions from the Canadian copper-nickel smelting industry.

METHOD: In-house development using historical emissions data, as provided by the individual companies concerned.

ANTICIPATED RESULTS: A report is presently available (EPS-3-AP-80-5, January 1981) in both official languages.

SUBJECT CODE: 1.1

PROJECT NUMBER: 9

TITLE: Inventory of Historical Emissions of SO_2 and NO_2.

PRINCIPAL INVESTIGATOR'S NAME: Arthur Sheffield
Data Analyst, Pollution Data Analysis Division

AGENCY AND DEPARTMENT: Environment Canada, EPS, Air Pollution Control Directorate

ADDRESS: Place Vincent Massey
Ottawa, Ontario
K1A 1C8

PHONE: (819) 997-3352

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE:

APPROXIMATE COST: 06/81 - 12/81 (Salary only)

OBJECTIVES: To prepare comprehensive inventories for the base years 1955 and 1965 of emissions of SO_2 and NO_2.

METHOD: In-house development by using historical data and available literature.

ANTICIPATED RESULTS: Report will not be prepared, but data are being used for internal purposes.

PROJECT NUMBER: 10

SUBJECT CODE: 1.1

TITLE: Emission Trends

PRINCIPAL INVESTIGATOR'S NAME: Arthur Sheffield
Data Analyst, Pollution Data Analysis Division

AGENCY AND DEPARTMENT: Environment Canada, EPS, Air Pollution Control Directorate

ADDRESS: Place Vincent Massey
Ottawa, Ontario
K1A 1C8

PHONE: (819) 997-3352

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE:

APPROXIMATE COST: 05/82 - 12/82 (Salary only)

OBJECTIVES: To develop an emission trends report for the five common contaminants for the years 1970-78.

METHOD: In-house development of a standardized inventory using previously developed information for point and area sources.

ANTICIPATED RESULTS: A draft report will be prepared in FY 82-83.

SUBJECT CODE: 1.1

PROJECT NUMBER: 11

TITLE: Emission Forecasting Models

PRINCIPAL INVESTIGATOR'S NAME: Arthur Sheffield
Data Analyst, Pollution Data Analysis Division

AGENCY AND DEPARTMENT: Environment Canada, EPS, Air Pollution Control Directorate

ADDRESS: Place Vincent Massey
Ottawa, Ontario
K1A 1C8

PHONE: (819) 997-3352

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: Design: 09/82 - 12/82
Program and Data Development)
Integration and Testing) dependent on design activity

APPROXIMATE COST: 09/82 - 12/82 ($25,000 + salary)

OBJECTIVES: To develop and operate emission forecasting models for various sectors and to assess various economic, energy and pollution control scenarios.

METHOD: Design phase is being contracted out to Mitre Corp. At the conclusion of the design phase, a decision will be made as to whether or not the model should be completed.

ANTICIPATED RESULTS: In the design phase, a functional specification report will be prepared, along with an estimate of the cost to complete the model development.

PROJECT NUMBER: 12

SUBJECT CODE: 1.1

TITLE: Inventory of Anthropogenic Emissions of Primary Sulphates and Nitrates (1978).

PRINCIPAL INVESTIGATOR'S NAME: Tony Kosteltz
Project Engineer, Pollution Data Analysis Division

AGENCY AND DEPARTMENT: Environment Canada, EPS, Air Pollution Control Directorate

ADDRESS: Place Vincent Massey
Ottawa, Ontario
K1A 1C8

PHONE: (819) 997-3352

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE:

APPROXIMATE COST: 10/81 - 02/82 - $25,000 (Contract only)

OBJECTIVES: To develop a comprehensive inventory of anthropogenic sources and emissions of primary sulphates and nitrates in Canada.

METHOD: Contract out to ORF, engineering consultant, with internal review for technical accuracy.

ANTICIPATED RESULTS: An executive summary report will be prepared in FY 82-83.

SUBJECT CODE: 1.1

PROJECT NUMBER: 13

TITLE: Inventory of Anthropogenic Sources and Emissions of Organic Compounds (1976)

PRINCIPAL INVESTIGATOR'S NAME: Wilfrid Jan, Project Engineer
Emissions Inventory Section
Pollution Data Analysis Division

AGENCY AND DEPARTMENT: Environment Canada, EPS, Air Pollution Control Directorate

ADDRESS: Place Vincent Massey
Ottawa, Ontario
K1A 1C8

PHONE: (819) 997-3352

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE:

APPROXIMATE COST: 11/80 - 3/81 - $45,000 (contract only)

OBJECTIVES: To prepare an inventory on anthropogenic sources and emissions of organic compounds in Canada, including development of a reactivity classification system.

METHOD: Contracted out to engineering consultant (Environmental Applications Group Ltd.) with internal review for technical accuracy.

ANTICIPATED RESULTS: An executive summary report will be prepared in FY 82-83.

PROJECT NUMBER: 14

SUBJECT CODE: 1.1

TITLE: Inventory of Anthropogenic Sources and Emissions of Fine Particulate Matter (1978)

PRINCIPAL INVESTIGATOR'S NAME: Tony Kosteltz, Project Engineer
Emissions Inventory Section
Pollution Data Analysis Division

AGENCY AND DEPARTMENT: Environment Canada, EPS, Air Pollution Control Directorate

ADDRESS: Place Vincent Massey
Ottawa, Ontario
K1A 1C8

PHONE: (819) 997-3352

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE:

APPROXIMATE COST: 10/80 - 3/81 - $75,000 (contract only)

OBJECTIVES: To prepare an inventory on anthropogenic sources and emissions of fine particulate matter, including particle size distribution profiles and chemical composition of the fine particulates.

METHOD: Contracted out to SNC/GECO, an engineering consultant, with internal review for technical accuracy.

ANTICIPATED RESULTS: An executive summary report will be prepared in FY 82-83.

SUBJECT CODE: 1.1

PROJECT NUMBER: 15

TITLE: Inventory of Anthropogenic Sources and Emission of Mercury (1978)

PRINCIPAL INVESTIGATOR'S NAME: Arthur Sheffield
Data Analyst, Pollution Data Analysis Division

AGENCY AND DEPARTMENT: Environment Canada, EPS, Air Pollution Control Directorate

ADDRESS: Place Vincent Massey
Ottawa, Ontario
K1A 1C8

PHONE: (819) 997-3352

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE:

APPROXIMATE COST: Salary costs only.

OBJECTIVES: To update the 1970 inventory of man-made sources and emissions of mercury in order to provide a more recent data base for LRTAP activities.

METHOD: In-house development of inventory by literature review and personal communications.

ANTICIPATED RESULTS: A final draft report has been completed. A final publication will be available in the fall of 1982.

PROJECT NUMBER: 16

SUBJECT CODE: 1.1

TITLE: Characterization and Quantification of Natural Emissions of Particulate Matter

PRINCIPAL INVESTIGATOR'S NAME: Arthur Sheffield
Data Analyst, Pollution Data Analysis Division

AGENCY AND DEPARTMENT: Environment Canada, EPS, Air Pollution Control Directorate

ADDRESS: Place Vincent Massey
Ottawa, Ontario
K1A 1C8

PHONE: (819) 997-3352

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE:

APPROXIMATE COST: 9/80 - 1/81 - $18,000 (Contract only)

OBJECTIVES: To prepare an inventory on natural sources and emissions of particulate matter in Canada.

METHOD: Contracted out to the Environmental Applications Group Ltd., an engineering consultant, with internal review for technical accuracy.

ANTICIPATED RESULTS: A report is now available in each of the two official languages.

SUBJECT CODE: 1.1

PROJECT NUMBER: 17

TITLE: Characterization and Quantification of Natural Emissions of Nitrogen and Mercury Compounds and Hydrocarbons

PRINCIPAL INVESTIGATOR'S NAME: Arthur Sheffield
Data Analyst, Pollution Data Analysis Division

AGENCY AND DEPARTMENT: Environment Canada, EPS, Air Pollution Control Directorate

ADDRESS: Place Vincent Massey
Ottawa, Ontario
K1A 1C8

PHONE: (819) 997-3352

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE:

APPROXIMATE COST: 9/79 - 3/80 - $45,000 (contract only)

OBJECTIVES: To prepare inventories on natural sources and emissions of nitrogen, mercury and organic compounds in Canada.

METHOD: Contracted out to the Environmental Applications Group Ltd., an engineering consultant, with internal review for technical accuracy.

ANTICIPATED RESULTS: A report for each of nitrogen, mercury and organic compounds is now available in each of the two official languages.

PROJECT NUMBER: 18

SUBJECT CODE: 1.1

TITLE: Characterization and Quantification of Natural Emissions of Sulphur Compounds

PRINCIPAL INVESTIGATOR'S NAME: Arthur Sheffield
Data Analyst, Pollution Data Analysis Division

AGENCY AND DEPARTMENT: Environment Canada, EPS, Air Pollution Control Directorate

ADDRESS: Place Vincent Massey
Ottawa, Ontario
K1A 1C8

PHONE: (819) 997-3352

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE:

APPROXIMATE COST: 10/78 - 2/79 - $25,000 (contract only)

OBJECTIVES: To prepare an inventory on natural sources and emissions of sulphur compounds in Canada.

METHOD: Contracted out to the Environmental Applications Group Ltd., an engineering consultant, with internal review for technical accuracy.

ANTICIPATED RESULTS: A report is presently available in published form (Report EPS 3-AP-79-2, Air Pollution Control Directorate, Environment Canada, February 1980) in both official languages.

SUBJECT CODE: 1.1

PROJECT NUMBER: 19

TITLE: Seasonal Variations in Emissions

PRINCIPAL INVESTIGATOR'S NAME: Tony Kosteltz, Project Engineer
Emissions Inventory Section
Pollution Data Analysis Division

AGENCY AND DEPARTMENT: Environment Canada, EPS, Air Pollution Control Directorate

ADDRESS: Place Vincent Massey
Ottawa, Ontario
K1A 1C8

PHONE: (819) 997-3352

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: Ongoing in-house.

APPROXIMATE COST: Salary only.

OBJECTIVES: To develop seasonal variations information for the following contaminants: particulate matter, SO_2, NO_x, hydrocarbons, CO.

METHOD:

a) Review of Literature

b) Personal communications

c) Questionnaires (in-house) for any available information.

ANTICIPATED RESULTS: Data will be used as part of the modelling component of the LRTAP program.

PROJECT NUMBER: 20

SUBJECT CODE: 1.1

TITLE: Gridded NO_X Emissions Inventory

PRINCIPAL INVESTIGATOR'S NAME: Frank Vena
Chief, Pollution Data Analysis Division

AGENCY AND DEPARTMENT: Environment Canada, EPS, Air Pollution Control Directorate

ADDRESS: Place Vincent Massey
Ottawa, Ontario
K1A 1C8

PHONE: (819) 997-3352

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: Ongoing in-house.

APPROXIMATE COST: Salary only.

OBJECTIVES: To prepare an updated (1978-80) NO_X emissions inventory for Canada on a 127km grid basis as required by the modelling component of the LRTAP program.

METHOD:

a) Point sources (large commercial/industrial establishments) are located within each specific grid cell (lat.-long. coordinates).

b) Area sources within each specific grid cell are agglomerated and presented as total NO_X emissions from each grid cell.

ANTICIPATED RESULTS: Canadian NO_X emission inventory (1978-80 data) on a 127km grid, in computer compatible format.

CODE DU SUJET: 1.1

NUMÉRO DE PROJET: 21

TITRE: Mesure des émissions de mercure provenant de l'exploitation des incinérateurs municipaux.

NOM DU CHERCHEUR RESPONSABLE: D. Pilon

MINISTÈRE, ORGANISME OU ORGANISME PRIVÉ, SERVICE: Environnement Canada, Service de la protection de l'environnement, Région du Québec

ADRESSE: Bureau 410
1550 ouest, boul. de Maisonneuve
Montréal, Québec
H3G 1N2

TÉLÉPHONE: (514) 283-7192

COLLABORATEUR(S), ORGANISME(S) ET CHERCHEUR(S):

DURÉE DE CHAQUE PHASE:

Prélèvements	Octobre, Novembre 1980
Analyses	Décembre 1980
Rapport préliminaire,	Janvier 1981
Rapport final	Mars 1981

COÛT APPROXIMATIF: Oct. 1980 - Mars 1981 - $19,000

OBJECTIFS DE TRAVAIL: Mesurer les émissions de mercure de 2 incinérateurs municipaux et relier ces émissions aux quantités de déchets alimentés afin d'en arriver, en tenant compte des dispositifs d'épuration utilisés, à des facteurs d'émissions applicables à d'autres incinérateurs municipaux à travers le Canada.

MÉTHODE DE TRAVAIL: Six mesures d'émissions de mercure à l'incinérateur de la Communauté Urbaine de Québec et six (6) mesures à l'incinérateur des Carrières de Montréal. Les prélèvements ont été faits selon la méthode normalisée EPS-1-AP-74-1 d'Environnement Canada modifiée pour l'analyse du mercure particulaire et gazeux.

Une évaluation des quantités de déchets alimentés lors des mesures d'émissions a été faite.

RÉSULTATS PRÉVUS: Les mesures effectuées aux incinérateurs de Montréal et Québec indiquent que les émissions de mercure y sont respectivement d'environ 1.2 et 3.1 g/tonne de déchet. On dénote aussi une différence marquée entre les deux incinérateurs au niveau du rapport mercure gazeux/particulaire.

PROJECT NUMBER: 22

SUBJECT CODE: I.1

TITLE: Annual Estimates of Atmospheric Emissions from Ontario Hydro's Thermal Generating Stations

PRINCIPAL INVESTIGATOR'S NAME: D. K. Gillies

AGENCY AND DEPARTMENT: Environmental Protection Dept. Central Thermal Services. Ontario Hydro

ADDRESS: 700 University Avenue
Toronto, Ontario
M5G 1X6
(AB-H4)

PHONE: (416) 592-4614

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: January-December - annually.

APPROXIMATE COST: 01/81 - 01/82 - $5000

OBJECTIVES: To estimate and report mass emissions of sulphur dioxide, nitric oxide and particulates as the result of burning fossil fuels to generate electricity.

METHOD: (a) Sulphur dioxide emissions are calculated from fuel consumption data and measured sulphur content of the fuel.

(b) Nitric oxide emissions are calculated from fuel consumption data and typical NO emission rates which have been measured at the facility burning that fuel.

(c) Particulate emissions are calculated from fuel consumption data, measured ash content of the fuels and measured emission control facility efficiencies.

ANTICIPATED RESULTS: Determination of Ontario Hydro's acid gas and particulate emissions from each emitting facility on a monthly and annual basis, from which estimates of impact of these emissions can be calculated.

CODE DU SUJET: 1.2

NUMÉRO DE PROJET: 23

TITRE: Développement d'un indice de pollution atmosphérique en fonction du Pb présent dans les sédiments lacustres

NOM DU CHERCHEUR RESPONSABLE: Marcel Ouellet

MINISTÈRE, ORGANISME OU ORGANISME PRIVÉ, SERVICE: INRS-Eau
Université du Québec

ADRESSE: C.P. 7500
Sainte-Foy (Québec)
G1V 4C7

TÉLÉPHONE: (418) 657-2555

COLLABORATEUR(S), ORGANISME(S) ET CHERCHEUR(S): H.G. Jones
même adresse

DURÉE DE CHAQUE PHASE:

a) échantillonnage: 1979-82
b) analyse: 1981-83
c) développement: 1982-83

COÛT APPROXIMATIF:

OBJECTIFS DE TRAVAIL: L'utilisation de la tendance évolutive du Pb dans plusieurs lacs non-perturbés du Québec nous permettra d'estimer l'évolution générale de l'acidification et des autres polluants atmosphériques depuis l'année 1900.

MÉTHODE DE TRAVAIL:

a) utilisation de la stratigraphie géochimique des sédiments lacustres;

b) datation des sédiments au ^{137}Cs et ^{210}Pb;

c) évaluation des bilans des substances polluantes d'origine atmosphérique.

RÉSULTATS PRÉVUS: Corrélation significative entre les distributions stratigraphiques et les quantités émises. Utilisation de la méthode pour estimer les abattements.

PROJECT NUMBER: 24

SUBJECT CODE: 1.2

TITLE: Feasibility Study of Retrofitting Dry FGD Processes

PRINCIPAL INVESTIGATOR'S NAME: Y. W. Jao

AGENCY AND DEPARTMENT: Ontario Hydro

ADDRESS: 700 University Avenue
Toronto, Ontario
M5G 1X6

PHONE: (416) 592-5191

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: 9 months.

APPROXIMATE COST:

OBJECTIVES: To carry out an economic and technical feasibility study of retrofitting dry FGD processes to Ontario Hydro generating stations.

METHOD: Use budget estimates and currently available operating experience to evaluate technical and economic feasibility. Economic feasibility will be assessed using total present worth methodology.

ANTICIPATED RESULTS: A report in mid 83 on the feasibility.

SUBJECT CODE: 1.2

PROJECT NUMBER: 25

TITLE: Canada/Nova Scotia Power Corp.
10,000 h Materials Corrosion Test
Program for Atmospheric Fluidized Bed Combustion

PRINCIPAL INVESTIGATOR'S NAME: Norman Andrews, Project Manager

AGENCY AND DEPARTMENT: Nova Scotia Power Corporation

ADDRESS: P. O. Box 910
Halifax, N.S.
B3J 2W5

PHONE: (902) 424-6367

COOPERATING AGENCIES AND INVESTIGATORS: CANMET, EMR
CE Canada Ltd.

DURATION OF EACH PHASE:

Construction	1982-83
10,000 h Test Program	1983-85
Specimen Evaluation	1983-86

APPROXIMATE COST: $8 million to 1986

OBJECTIVES: Establish best candidate metals for FBC boiler applications. Reduce risk in design of utility-scale FBC boilers.

METHOD:

- Build a 1 m^2 pilot-scale FBC at Point Tupper, N.S.
- Expose candidate boiler materials to FBC environment for up to 10,000 h.
- Evaluate material degradation.

ANTICIPATED RESULTS: Reduce risk of applying FBC technology on utility scale to the utilization of high-sulphur coal for power generation.

PROJECT NUMBER: 26

SUBJECT CODE: 1.2

TITLE: Pilot-Scale R & D on Fluidized Bed Combustion of High Sulphur Coal with Sulphur Capture by Limestone

PRINCIPAL INVESTIGATOR'S NAME: Prof. H.A. Becker

AGENCY AND DEPARTMENT: Queen's University

ADDRESS: Dept. of Chemical Engineering
Queen's University
Kingston, Ontario

PHONE:

COOPERATING AGENCIES AND INVESTIGATORS: CANMET, EMR (Sponsor)

DURATION OF EACH PHASE: Continuing

APPROXIMATE COST: $130,000/year

OBJECTIVES: To generate data on sulphur-capture performance of Canadian limestone with high-sulphur eastern Canadian coals

To investigate sulphur capture mechanisms and means for optimizing them

METHOD: Diagram of pilot-scale tests in an atmospheric fluidized bed combustor using various coals and limestones.

ANTICIPATED RESULTS: Information which will expedite the application of FBC technology for utilization of high-sulphur coals.

SUBJECT CODE: 1.2

PROJECT NUMBER: 27

TITLE: Fluidized-Bed Combustion of Syncrude Coke

PRINCIPAL INVESTIGATOR'S NAME: F.D. Friedrich

AGENCY AND DEPARTMENT: CANMET, EMR

ADDRESS: CANMET, Energy Research Laboratories
555 Booth Street
Ottawa, Ontario
K1A 0G1

PHONE: (613) 996-4570
Ext. 181

COOPERATING AGENCIES AND INVESTIGATORS:
Syncrude Canada Ltd.
AOSTRA
A Ahlstrom Ltd.

DURATION OF EACH PHASE:
Phase 1: Pilot-scale exploratory tests in atmospheric recirculating FBC; Finland, 1981
Phase 2: Pilot-scale optimizing tests in ARFBC with McMurray limestone, 1983

APPROXIMATE COST:
Phase 1: $35,000
Phase 2: $100,000 (est)

OBJECTIVES:
- Determine suitability of ARFBC technology for burning high-sulphur Syncrude coke.
- Determine ARFBC operating conditions for optimum combustion and sulphur capture, using McMurray limestone as sulphur sorbent.

METHOD: Pilot-scale tests in an atmospheric recirculating fluidized bed combustor while measuring emissions

ANTICIPATED RESULTS: Pilot-scale demonstration of an environmentally-benign technology for utilizing high-sulphur coke from oil sands production.

PROJECT NUMBER: 28

SUBJECT CODE: 1.2

TITLE: International Energy Agency Project for Control of Nitrogen Oxides During Coal Combustion

PRINCIPAL INVESTIGATOR'S NAME: M. P. Heap

AGENCY AND DEPARTMENT: Environmental and Energy Research Corp.

ADDRESS: 18 Mason Boulevard
Irvine, CA 92714
U.S.A.

PHONE: (714) 859-8851

COOPERATING AGENCIES AND INVESTIGATORS:

a) EMR/CANMET
G.K. Lee & W.A. Warfe
Ottawa

b) Swedish Power Authority
R. Carlson, Stockholm

c) U.S. Environmental Protection Agency, D. Drehmel, Research rk Triangle Park, W. Va.

d) Danish Ministry of Energy
E. Rosenberg, Kollerup; Denma

DURATION OF EACH PHASE: Large-scale combustion simulator trials 1982-83.

APPROXIMATE COST: $200 K (Canadian Contribution)

OBJECTIVES: To elucidate mechanisms of NO_X and SO_X reduction during pulverized coal combustion using burner aerodynamics and additive injection.

METHOD:

- Evaluate 4 coals (2 from Canada) under conditions similar to those in power utility boilers for NO_X formation.
- Use 2 of above coals to determine parameters influencing simultaneous reduction of SO_X and NO_X.

ANTICIPATED RESULTS:

- Identify mechanisms of NO_X formation during combustion of different ranks of coal.
- Determine trade-offs, if any, for simultaneous NO_X and SO_X reductions.
- Develop burner concepts for low NO_X, low SO_X combustion.

SUBJECT CODE: 1.2

PROJECT NUMBER: 29

TITLE: CFB Summerside Project

PRINCIPAL INVESTIGATOR'S NAME: F. D. Friedrich

AGENCY AND DEPARTMENT: CANMET, EMR

ADDRESS: CANMET, Energy Research Laboratories
555 Booth Street
Ottawa, Ontario
K1A 0G1

PHONE: (613) 996-4570
Ext. 181

COOPERATING AGENCIES AND INVESTIGATORS: Defence Canada
Environment Canada

DURATION OF EACH PHASE: Phase 4: Construction to be completed Jan/82
Phase 5: Demonstration Program: Feb 83 to May 84

APPROXIMATE COST: Phase 4: $13.6 million
Phase 5: Approx. $200,000/year

OBJECTIVES: To demonstrate full-scale fluidized bed boilers burning high sulphur coal with sulphur capture by limestone addition.

METHOD: Build a 2-boiler heating plant at CFB Summerside and operate with high-sulphur Maritime coals while measuring emissions.

ANTICIPATED RESULTS: Demonstration of FBC technology for environmentally benign utilization of high-sulphur coal.

PROJECT NUMBER: 30

SUBJECT CODE: 1.2

TITLE: Pilot-Scale R & D on Fluidized Bed Combustion

PRINCIPAL INVESTIGATOR'S NAME: F. D. Friedrich

AGENCY AND DEPARTMENT: CANMET, EMR

ADDRESS: CANMET, Energy Research Laboratories
555 Booth Street
Ottawa, Ontario
K1A 0G1

PHONE: (613) 996-4570
Ext. 181

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: Continuing

APPROXIMATE COST: $200,000/year

OBJECTIVES: Generate data on fluidized-bed combustion performance of a variety of Canadian coals and other fuels, including aspects of sulphur capture and heavy metals emissions.

METHOD: Parametric pilot-scale tests and measurement of emissions.

ANTICIPATED RESULTS: Information which will expedite the application of FBC technology for environmentally benign utilization of low-grade fuels.

SUBJECT CODE: 1.2

PROJECT NUMBER: 31

TITLE: Combustion Evaluation of $CaCO_3$ and Freezing Inhibitors ($CaCl_2$) for Sulphur Absorption During Coal Combustion

PRINCIPAL INVESTIGATOR'S NAME: Dr. H. Whaley

AGENCY AND DEPARTMENT: CANMET, EMR

ADDRESS: CANMET, Energy Research Laboratories
555 Booth Street
Ottawa, Ontario
K1A 0G1

PHONE: (613) 996-4570
Ext. 238

COOPERATING AGENCIES AND INVESTIGATORS: Allied Chemical Canada Ltd.

DURATION OF EACH PHASE: 1 Month

APPROXIMATE COST: $35,000

OBJECTIVES: To assess the roles of $CaCO_3$ and $CaCl_2$ as sulphur dioxide absorbents during the combustion of coal (these materials are added in winter to inhibit freezing of coal piles).

METHOD: Combustion in 8 h test program in CCRL pilot-scale research boiler.

ANTICIPATED RESULTS: An indication of the effectiveness of $CaCO_3$ and $CaCl_2$ under controlled combustion conditions in SO_2 and possibly NO_x reduction.

PROJECT NUMBER: 32

SUBJECT CODE: 1.2

TITLE: SO_2 Capture by Pyrrhotite and by Limestone/Lime

PRINCIPAL INVESTIGATOR'S NAME: S. A. Mikhail, C. A. Hamer

AGENCY AND DEPARTMENT: CANMET, EMR

ADDRESS: CANMET, Energy Research Laboratories
555 Booth Street
Ottawa, Ontario
K1A 0G1

PHONE: (613) 995-4641

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: 04/82 - 04/83

APPROXIMATE COST: 1.5PY, $30K capital

OBJECTIVES: To investigate on a laboratory scale the possibility of capturing SO_2 by reaction with pyrrhotite.

To investigate on a laboratory scale the factors that govern the effectiveness of limestone and lime for SO_2 capture.

METHOD:

1. Preliminary studies will be made on the possible reaction of SO_2 with pyrrhotite (FeS). The reaction of SO_2 with dry pyrrhotite will be investigated by thermal analysis, and with aqueous slurries of pyrrhotite at atmospheric pressure. Potential for use of FeS will be assessed.
2. The literature on reactions of SO_2 with dry limestone ($CaCO_3$) and lime (CaO) will be reviewed.
3. Preliminary DTA and TG studies on SO_2 capture by limestone will be started, with emphasis on any factors that appear to be still unresolved on the basis of the literature review.

ANTICIPATED RESULTS:

SUBJECT CODE: 1.2

PROJECT NUMBER: 33

TITLE: Industrial Demonstration of Coal Liquid Mixture Technology

PRINCIPAL INVESTIGATOR'S NAME: K. F. Burrill

AGENCY AND DEPARTMENT: Scotia Liquicoal

ADDRESS: P.O. Box 1074
Halifax, N.S.

PHONE:

COOPERATING AGENCIES AND INVESTIGATORS:

CANMET-EMR	Dr. H. Whaley
NRC	Dr. C. E. Capes

DURATION OF EACH PHASE: Continuing

APPROXIMATE COST: $50,000

OBJECTIVES: To determine whether coal-oil emulsion fuels are viable in industrial boilers and process combustors.

METHOD: Fuel preparation and burner technology development programs. In fuel preparation the NRC oil agglomeration process significantly reduces fuel sulphur content. Industrial demonstration programs collaborating with the industry are proposed.

ANTICIPATED RESULTS: Comparative tests showing the reduction in SO_2 due to reduced fuel sulphur content.

PROJECT NUMBER: 34

SUBJECT CODE: 1.2

TITLE: N.E.P. Coal/Water Initiatives: Combustion of Coal-Water Mixtures in Utility Boilers

PRINCIPAL INVESTIGATOR'S NAME: D. Rankin

AGENCY AND DEPARTMENT: New Brunswick Electric Power Commission

ADDRESS: 527 King Street
Fredericton, N.B.
E3B 4X1

PHONE:

COOPERATING AGENCIES AND INVESTIGATORS: EMR Canada
Dr. H. Whaley - CANMET
Dr. P. J. Read - EPS-Coal

DURATION OF EACH PHASE: 1 Year

APPROXIMATE COST: $\$1 \times 10^6$

OBJECTIVES: To establish combustion technology for highly cleaned coal in the form of slurries with 20-30% water (sulphur and ash contents are reduced significantly in preparation).

METHOD: Test program of burner development and subsequent testing in 2 power generating boilers at Chatham, N.B. Scheduled for Summer of 1983.

ANTICIPATED RESULTS: Reduced SO_2 emissions from utility boilers due to utilization of significantly reduced sulphur content coal slurry fuels when compared to alternative fuel strategies (i.e. pulverized coal or fuel oil).

SUBJECT CODE: 1.2

PROJECT NUMBER: 35

TITLE: Continuous Sulfur Dioxide Monitoring

PRINCIPAL INVESTIGATOR'S NAME: W. W. Fraser, Director Safety and Environment

AGENCY AND DEPARTMENT: Hudson Bay Mining and Smelting Co., Ltd.

ADDRESS: Environment Department
P.O. Box 1500
Flin Flon, Manitoba

PHONE: (204) 687-5221

COOPERATING AGENCIES AND INVESTIGATORS: Manitoba Government Environmental Management Division

DURATION OF EACH PHASE: Ongoing

APPROXIMATE COST: $15,000/year

OBJECTIVES: To collect continuous SO_2 data in close proximity to Flin Flon stack.

To provide data regarding maximum ground level SO_2 concentrations in the area.

To indicate excursions of Man. and Sask. Environmental limits.

METHOD: 5 sample locations 1-3 miles from stack
- 2 locations operated by Manitoba Government
- 3 locations operated by HBM&S

Pulsed fluorescent analyzer - Thermo Electric Corporation.

ANTICIPATED RESULTS:

PROJECT NUMBER: 36

SUBJECT CODE: 1.2

TITLE: Emission Inventory

PRINCIPAL INVESTIGATOR'S NAME: Mr. O. J. Betancourt

AGENCY AND DEPARTMENT: Nova Scotia Power Corporation
Thermal Production Division

ADDRESS: P. O. Box 910
Halifax, N.S.
B3J 2W5

PHONE: (902) 424-5874

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: Emission data for SO_2, NO_X and particulates reported on a monthly basis. Annual emission rates prepared at the end of each year.

APPROXIMATE COST:

OBJECTIVES: To provide emission data for NSPC's Thermal Generating Station by individual boiler and by plant (the latter on a monthly and annual basis) for particulates, NO_X and SO_2.

METHOD:

1. Particulate emissions are calculated using EPA emission factors, except for oil-fired boilers where emission is based on actual stack measurements.
2. Sulphur dioxide emissions are calculated based on fuel consumption and sulphur content.
3. Nitrogen oxide emissions calculated using EPA emission factors, except for a number of boilers where NO_X emissions have been measured.

ANTICIPATED RESULTS: Data obtained will be able to provide the trend and quantity of NSPC's emissions of particulates, NO_2 and SO_2.

SUBJECT CODE: 1.2

PROJECT NUMBER: 37

TITLE: Evaluation of SO_2 Emission Reduction Options for NSPC Thermal Generating Stations

PRINCIPAL INVESTIGATOR'S NAME: D. K. Blamire

AGENCY AND DEPARTMENT: Nova Scotia Power Corporation, Thermal Studies Dept. Design & Construction Division

ADDRESS: P. O. Box 910
Halifax, N.S.
B3J 2W5

PHONE: (902) 424-6655

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: Initial Survey Report issued August, 1982.
Yearly update to be prepared.

APPROXIMATE COST: To 08/82 - $20,000

OBJECTIVES: To identify the most economically and technically viable options available to NSPC for the reduction of thermal generating station emission of sulphur dioxide.

METHOD: An extensive literature review and vendor/used data assessment was carried out throughout 1981/82 which resulted in the preparation of a comprehensive report documenting the state of the art of the SO_2 control technology marketplace. A "Short List" of viable options was generated considering the prevailing conditions in Nova Scotia.

It is intended that developments in the SO_2 emission control field continue to be monitored through literature review, maintaining contact with knowledgeable sources, participation in the Canadian Electrical Association Advisory Panel on FGD, participation in the Atlantic Coal Working Group on Coal Beneficiation and attendance of selected symposia.

ANTICIPATED RESULTS: NSPC will be kept advised of the most viable approach to reducing SO_2 emissions considering local conditions. This will allow the Corporation to develop sound and timely decisions should SO_2 control be introduced.

PROJECT NUMBER: 38

SUBJECT CODE: 1.2

TITLE: Cost Analysis of Sulphur Dioxide Emission Controls

PRINCIPAL INVESTIGATOR'S NAME: D. K. Blamire

AGENCY AND DEPARTMENT: NSPC, Thermal Studies

ADDRESS: P. O. Box 910
Halifax, N.S.
B3J 2W5

PHONE: (902) 424-6655

COOPERATING AGENCIES AND INVESTIGATORS: MacLaren Plansearch

DURATION OF EACH PHASE: 1 Year. Completed June/1982.

APPROXIMATE COST: $20,000

OBJECTIVES: To estimate the capital and operating costs of FGD equipment for NSPC's generating stations, coal-fired and oil-fired (assumed conversion to coal).

METHOD: Cost estimates derived by Teknekron Inc. of Berkeley, California using a computer model based on experience with FGD in the United States.

ANTICIPATED RESULTS: Provide a summary of the capital and operating costs of FGD equipment installed on each unit of NSPC's thermal generating stations according to coal used for firing, the level of emission control and the type of FGD equipment.

SUBJECT CODE: 1.2

PROJECT NUMBER: 39

TITLE: A Review of the Technology Available for the Control of Atmospheric Emissions from Oil Sands Plants

PRINCIPAL INVESTIGATOR'S NAME: Dr. Harby Sandhu

AGENCY AND DEPARTMENT: Research Management Division, Alberta Environment

ADDRESS: 14th Floor, Standard Life Centre
10405 Jasper Avenue
Edmonton, Alberta
T5J 3N4

PHONE: (403) 427-3943

COOPERATING AGENCIES AND INVESTIGATORS: Work contracted out to Dynawest Projects Ltd., 200, 10201 Southport Road S.W., Calgary, Alberta T2W 4X9 (403) 253-2545

DURATION OF EACH PHASE: 1982 -

APPROXIMATE COST: $90,000 (82-83)

OBJECTIVES: The study is a literature review of current technologies available for gaseous emission control from industrial sources used in the Oil Sands area.

METHOD: Contact principal investigator for project methodology.

ANTICIPATED RESULTS: A final report is in publication and will be available at the end of 1982 from the Research Management Division, Alberta Environment.

PROJECT NUMBER: 40

SUBJECT CODE: 1.2

TITLE: Capture/Fixation of Dilute SO_2 Gases

PRINCIPAL INVESTIGATOR'S NAME: J. Palmer

AGENCY AND DEPARTMENT: EMR CANMET

ADDRESS: CANMET, Energy Research Laboratories
555 Booth Street
Ottawa, Ontario
K1A 0G1

PHONE: (613) 995-4911

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: 04/82 to 04/83

APPROXIMATE COST:

OBJECTIVES: To evaluate processes which could be applied to smelters for converting dilute SO_2 to saleable products other than H_2SO_4.

METHOD: Carry out preliminary economic evaluation of process alternatives for producing fertilizers or elemental sulfur and recommend potentially attractive options.

ANTICIPATED RESULTS: Report on alternatives.

SUBJECT CODE: 1.2

PROJECT NUMBER: 41

TITLE: Studies on the Chemistry of Dual Catalyst Liquid Redox Desulfurization Technologies

PRINCIPAL INVESTIGATOR'S NAME: Professor O. E. Hileman, Jr.

AGENCY AND DEPARTMENT: McMaster University, Chemistry

ADDRESS: Hamilton, Ontario
L8S 4M1

PHONE: (416) 525-9140
Ext. 4507

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: 1st phase - 3 years

2nd phase - 3 years

APPROXIMATE COST: $35,000/year

OBJECTIVES: The overall objective is the improvement of existing technologies for the desulfurization of sour by-product fuel gases, reduced industrial off-gases and residual gases (Claus kiln tail gas, refinery off-gases).

METHOD: The research program is divided into fundamental and empirical studies. The figure shows a block diagram of the program components and the sequencing of various activities.

EMPIRICAL

Bench Scale Stirred Batch Reactor

1. Design/Construction
2. Commissioning
3. Kinetic Studies on the Uncatalyzed Oxidation of Vanadium (IV) with "Air"
4. Kinetic Studies on the Catalyzed Oxidation of Vanadium (IV) with "Air"
5. Evaluation of Alternatives for the Vanadium (IV) Oxidation Catalyst

Bench Scale Cyclic Continuous Reactor

1. Design/Construction
2. Commissioning
3. Stretford-Like Solutions
   A. Rate of By-Product Formation
   B. Rate of Catalyst Loss/Degradation
4. Evaluation of Alternatives for the Vanadium (IV) Oxidation Catalyst and the Hydrosulfide Oxidation Catalyst

FUNDAMENTAL

Speciation in Stretford-Like Solutions

1. Vanadium (IV) Oxidation Catalyst
   A. Quinones
   B. Oxygen
2. Sulfide Oxidation Catalyst
   Vanadium (V and IV)
3. Polysulfide

Mechanisms of Redox Reactions

1. Vanadium (IV)/Quinone/Oxygen Reactions
2. Vanadium (V)/Hydrosulfide Reaction
3. By-Product Formation
   ($S_2O_3^{2-}$, SO_4^{2-})
4. Loss of Catalyst Activity

ANTICIPATED RESULTS: The generation of new catalyst system.

SECTION 2

ATMOSPHERIC

SUBJECT CODE: 2.1.1

PROJECT NUMBER: 42

TITLE: Collection of Particulate Emission Data from Output of Local Thermal Generating Plant

PRINCIPAL INVESTIGATOR'S NAME: Judy Skidmore/Andrea Fugate

AGENCY AND DEPARTMENT: Newfoundland & Labrador Hydro - Environmental Services Department.

ADDRESS: P. O. Box 9100
St. John's, Newfoundland
A1A 2X8

PHONE: 737-1744

COOPERATING AGENCIES AND INVESTIGATORS: Newfoundland Department of Environment
Environment Canada - Environmental Protection Service.

DURATION OF EACH PHASE:

APPROXIMATE COST: $20,000 - $25,000

OBJECTIVES: To monitor the Ground Level Concentrations (GLC) of particulate emissions from the plant with regard to the National Emissions Guidelines.

METHOD: High-volume Air Samplers are situated 2000 m and 7500 m from the plant. A set volume of air is drawn through a filter of known weight once every 13 days for a 24 hour period. A concentration of particulate matter can be determined based on the volume of air and the weight of the exposed filter.

ANTICIPATED RESULTS: Although the results are not consistent with the plant output, they are within the acceptable limit with regard to the National Emission Guidelines.

PROJECT NUMBER: 43

SUBJECT CODE: 2.1.1

TITLE: Collection of SO_2 Data from Output of Local Thermal Generating Plant

PRINCIPAL INVESTIGATOR'S NAME: Judy Skidmore/Andrea Fugate

AGENCY AND DEPARTMENT: Newfoundland & Labrador Hydro - Environmental Services Department

ADDRESS: P. O. Box 9100
St. Johns, Newfoundland
A1A 2X8

PHONE: 737-1744

COOPERATING AGENCIES AND INVESTIGATORS: Newfoundland Department of Environment
Environment Canada - Environmental Protection Service

DURATION OF EACH PHASE:

APPROXIMATE COST: $20,000 - $25,000

OBJECTIVES: To monitor the Ground Level Concentrations (GLC) of SO_2 emissions from the plant with regard to the National Emissions Guidelines.

METHOD: Philips SO_2 monitoring units with data recorders are situated 2000 m and 7500 m from the plant. Air is drawn under vacuum into the analyzers and a measurement of the SO_2 in the air is made continuously. This measurement is recorded on a roll chart, from which concentrations of SO_2 are calculated in terms of parts per hundred million (pphm).

ANTICIPATED RESULTS: Although the results are not consistent with the plant output, they are within the acceptable limit with regard to the National Emissions Guidelines.

SUBJECT CODE: 2.1.2

PROJECT NUMBER: 44

TITLE: Minisonde Data Collection and Ambient Air Monitoring at Tufts Cove Generating Station

PRINCIPAL INVESTIGATOR'S NAME: Mr. O. J. Betancourt

AGENCY AND DEPARTMENT: Nova Scotia Power Corporation
Thermal Production Division

ADDRESS: P. O. Box 910
Halifax, N.S.
B3J 2W5

PHONE: (902) 424-5874

COOPERATING AGENCIES AND INVESTIGATORS: Atmospheric Environment Service, Mr. E. Brandon

DURATION OF EACH PHASE: To be completed fall, 1982.

APPROXIMATE COST: $25 - $30,000

OBJECTIVES: To collect minisonde data and SO_2 concentration in vicinity of Tufts Cove generating station located in Dartmouth, N.S. for a 17 day period during the summer of 1982.

METHOD: 1) A helium-filled balloon is launched carrying a fast-response temperature sensing device and a transmitter which sends a continuous record of the atmospheric temperature to a receiver which records it on a calibrated moving chart. The balloon is tracked by two theodolites which are located at each end of base line, located perpendicular to the wind direction.

2) The plume is located and the SO_2 concentration is monitored with a TECO SO_2 monitor located inside a mobile trailer.

ANTICIPATED RESULTS: The minisonde and SO_2 concentration data will be analyzed for the purpose of providing validation of the MPTER near-field dispersion model.

PROJECT NUMBER: 45

SUBJECT CODE: 2.1.2

TITLE: Cloud/Precipitation/Pollutant Interactions

PRINCIPAL INVESTIGATOR'S NAME: J. Grabenstetter

AGENCY AND DEPARTMENT: Ontario Hydro Research Division

ADDRESS: 800 Kipling Avenue
Toronto, Ontario
M8Z 5S4

PHONE: (416) 231-4111

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: July, 1983 to December, 1985

APPROXIMATE COST:

OBJECTIVES: Determine the role of cloud systems in (a) producing sites for the chemical conversion of acidic pollutants and (b) redistributing pollutants into different air flows (elevations) and precipitation. Use the information thus derived to guide the development of long range transport models and to interpret precipitation chemistry data.

METHOD: Precipitation chemistry data for eastern Canada will be used to identify the important cloud and precipitation systems associated with acidic deposition. The identified synoptic conditions will then be characterized in terms of (a) the types and dynamics of mesoscale circulations and the associated cloud precipitation systems, (b) the vertical transport of pollutants caused by meso- and smaller scale circulations and cloud systems, (c) cloud physics (temperature of cloud base, vertical velocities, liquid water content, type of droplet size distribution and precipitation, (d) cloud chemistry (ambient concentrations, gaseous diffusion, solubilization, ionic equilibria and oxidation reactions), (e) analysis of rate determining processes, (f) elimination processes (rainout, washout and outflow into upper and lower air circulation), (g) parameterization.

ANTICIPATED RESULTS: The results will hopefully guide the development of long range transport models and provide mathematical descriptions of cloud/precipitation/pollutant interactions for use in such models.

SUBJECT CODE: 2.1.2

PROJECT NUMBER: 46

TITLE: Relationships between Precipitation and Wind Fields within Storms and Sequential Acid Precipitation Measurements

PRINCIPAL INVESTIGATOR'S NAME: Prof. Ronald Stewart

AGENCY AND DEPARTMENT: Physics Dept.

ADDRESS: University of Toronto
Toronto, Ontario
M5S 1A7

PHONE:

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: Until Summer, 1983.

APPROXIMATE COST:

OBJECTIVES: To show that the changing characteristics of precipitation formation within storms over southern Ontario can account for changes in the degree of acidity of precipitation and to suggest how a better understanding of precipitation formation can assist in understanding the mechanisms of pollutant evolution and transport within storms.

METHOD: The study will use the vertical and horizontal radar information obtained during field projects in November 1981 and July 1982. This information will be related to the sequential acid precipitation samples which were obtained while rawinsondes were being released in support of the Rainsat short-term forecasting project. Conceptual models of precipitation formation within the storms will be developed from these data sets. The applicability of these limiting values to more general situations will be approached.

ANTICIPATED RESULTS:

PROJECT NUMBER: 47

SUBJECT CODE: 2.1.2

TITLE: A Study of the Effects of Clouds and Mesoscale Processes on LRTAP

PRINCIPAL INVESTIGATOR'S NAME: J. V. Iribarne/H. R. Cho

AGENCY AND DEPARTMENT: Department of Physics

ADDRESS: University of Toronto
Toronto, Ontario
M5S 1A7

PHONE: (416) 978-4992

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: 3 years
Preliminary work has begun

APPROXIMATE COST:

OBJECTIVES: To study the effects of clouds and mesoscale processes on the Long-Range Transport of Air Pollutants.

METHOD: The Long-Range Trajectory of air pollutants and the distribution of acid precipitation depend on the chemical processes in clouds, and the vertical transport processes by meso- and smaller scale circulations of the atmosphere. These processes are poorly represented in current long-range transport models.

In cooperation with the Atmospheric Research Division, Ontario Hydro, the Dept. of Physics, University of Toronto will study this problem.

ANTICIPATED RESULTS:

CODE DU SUJET: 2.1.3

NUMÉRO DE PROJET: 48

TITRE: L'influence des conditions météorologiques hydrologiques et pédologiques sur l'acidité de l'eau et des sols dans un bassin versant des Basses Laurentides, Québec.

NOM DU CHERCHEUR RESPONSABLE: Bhawan Singh

MINISTÈRE, ORGANISME OU ORGANISME PRIVÉ, SERVICE: Département de géographie, Université de Montréal

ADRESSE: Case Postale 6128, Succursale "A"
Montréal, Québec
H3C 3J7

TÉLÉPHONE: (514) 270-3443

COLLABORATEUR(S), ORGANISME(S) ET CHERCHEUR(S):

DURÉE DE CHAQUE PHASE: Juin 1982 à Août 1985

COÛT APPROXIMATIF: $60,000

OBJECTIFS DE TRAVAIL: Les objectifs de cette étude sont nombreux et globaux. Nous avons comme but d'essayer d'estimer le taux de dépôt de pollutants dans un bassin versant des Basses Laurentides, ceci pour chaque chute de précipitation et par rapport au trajectoire de la masse d'air pluvieuse et les conditions météorologiques prévalentes. Ensuite nous allons examiner les changements de la composition chimique de l'eau précipitée au fur et à mesure qu'elle se déplace à travers la végétation et les sols dans le but d'étudier spécifiquement le sort des ions acidiques (SO_4, NO_3, etc) l'influence de ceux-ci sur les propriétés chimiques des sols, tel la relâche d'autres éléments toxiques que l'aluminium et finalement la chimie du filtrage du sol par rapport à la chimie de l'eau qui draine dans les ruisseaux et dans les lacs. L'utilité d'une telle étude sera premièrement une avance de la connaissance théorique des facteurs qui règlent la qualité de l'eau des ruisseaux et les lacs et les variations chimiques des sols soumis à l'influence des précipitations acidifiées. Celle-ci fournira une conscience plus profonde de la susceptibilité des eaux et des sols face à des précipitations acides et elle aidera dans la formulation de stratégies et dans la distribution des ressources à combattre ces menaces.

MÉTHODE DE TRAVAIL: C'est bien connu que l'acidité des précipitations dans le nord-est du continent nord-américain représente une menace dangereuse aux systèmes aquatiques, spécifiquement les sols et les eaux des rivières et des lacs. Ces problèms de l'acidification sont même plus prononcés dans les régions où l'effet tampon des sol et de la roche en place sur l'acidité de la précipitation est très faible, tel qu'il est dans les Basses Laurentides du Québec. De plus, il a été démontré que la région québécoise est une zone réceptrice des polluants toxiques, ceux-ci dûs au transport à longue portée de ces matières par la voie de masses d'air en provenance des régions industrialisées des Etats-Unis et de l'Ontario. Ces précipitations acidifiées une fois tombées sur la région à l'étude se déplacent à travers la végétation, les sols, les ruisseaux et se drainent finalement dans les lacs. Alors l'acidité finale de l'eau déchargée d'un bassin versant va dépendre de l'acidité de la précipitation elle-même et des intéractions chimiques entre celle-ci et la végétation, les sols, les eaux en place dans le sol et dans les ruisseaux. La composition chimique des sols et la qualité des eaux dans les ruisseaux et dans les lacs va dépendre, à courte et à longue échéance de intéractions entre ces mêmes facteurs cités.

PROJECT NUMBER: 49

SUBJECT CODE: 2.1.3

TITLE: Study of High Deposition Events at an Atlantic Canada Site

PRINCIPAL INVESTIGATOR'S NAME: B. L. Taylor

AGENCY AND DEPARTMENT: Atmospheric Environment Service
Environment Canada

ADDRESS: 1496 Bedford Highway
Bedford, Nova Scotia
B4A 1E5

PHONE: (902) 835-9529

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: Beginning January 1983 until March 1984.

APPROXIMATE COST:

OBJECTIVES: To understand and explain the meteorological reasons for high deposition events at Kejimkujik National Park, N.S., with a view to developing a predictive ability.

METHOD: From 5 to 10 high deposition events per year at Kejimkujik National Park, N.S., will be chosen, based on the APN precipitation data set.

The meteorological conditions for these events will be studied to determine the important variables (type of weather system, source region for pollutants, etc.).

If possible, a predictive scheme will be developed.

ANTICIPATED RESULTS:

SUBJECT CODE: 2.1.3

PROJECT NUMBER: 50

TITLE: Climatology of Fog in the Atlantic Provinces

PRINCIPAL INVESTIGATOR'S NAME: B. L. Taylor

AGENCY AND DEPARTMENT: Atmospheric Environment Service
Environment Canada

ADDRESS: 1496 Bedford Highway
Bedford, Nova Scotia
B4A 1E5

PHONE: (902) 835-9529

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE:

APPROXIMATE COST:

OBJECTIVES: To produce a spatial representation of the percentage frequency of fog by seasons for the Atlantic Provinces, as input to the determination of the quantity of pollutants that are deposited directly onto the earth's surface by clouds that touch the ground.

METHOD: Before the fog statistics can be produced and mapped, a methodology for extrapolating the frequency of fog and low cloud as observed at first order weather stations to surrounding terrain (which may be higher, lower and either similar or dissimilar climatologically) must be developed.

ANTICIPATED RESULTS: Beginning January 1983, for one to two years.

PROJECT NUMBER: 51

SUBJECT CODE: 2.2.1

TITLE: Air Quality Data Acquisition Research on Permanent Sample Plots

PRINCIPAL INVESTIGATOR'S NAME: Mr. B. Munson

AGENCY AND DEPARTMENT: Research Management Division, Alberta Environment

ADDRESS: 14th Floor, Standard Life Centre
10405 Jasper Avenue
Edmonton, Alberta
T5J 3N4

PHONE: (403) 427-3943

COOPERATING AGENCIES AND INVESTIGATORS: Work contracted out to Promet Environmental Group Ltd.:
Bay 'P', 1338-36 Avenue N.E., Calgary, Alberta, T2E 6T6
(403) 276-9123

DURATION OF EACH PHASE: Commenced 1982

APPROXIMATE COST: $61,400 (82-83)

OBJECTIVES: Air quality data acquisition from three stations in the Athabasca Oil Sands region is underway. Continued sampling is expected to provide background data for present and future aquatic and terrestrial programmes.

METHOD: Contact principal investigator for project procedures.

ANTICIPATED RESULTS: Interim results will be available in March 1983 from the Research Management Division, Alberta Environment.

SUBJECT CODE: 2.2.1

PROJECT NUMBER: 52

TITLE: Lower B.C. Mainland Precipitation Chemistry Study

PRINCIPAL INVESTIGATOR'S NAME: S. Nikleva

AGENCY AND DEPARTMENT: Atmospheric Environment Service

ADDRESS: Pacific Regional Office
Field Service Directorate
Vancouver, B.C.

PHONE:

COOPERATING AGENCIES AND INVESTIGATORS: Dr. G. A. McBean
Institute of Ocean Sciences
Sydney, B.C.

DURATION OF EACH PHASE:

APPROXIMATE COST: 8.3K 82/83

OBJECTIVES: To establish a ten station network in the lower mainland area to better define variability and identify problems with local emissions.

METHOD: The results of the CANSAP network station at Vancouver do not provide any indication of areal variability of precipitation chemistry in the lower mainland and may be subject to local effects. Samples in the new network will be collected on an event basis. Event sampling stations at high elevations in this area (Grouse, Seymour and Whistler) will be established to provide information on the variation of pH with altitude. Snowpack samples will also be taken.

ANTICIPATED RESULTS: Guidance may be derived from these results for a better location for the CANSAP/CAPMON station at the Vancouver International Airport. A report on 1982 measurements is expected by December 1982.

PROJECT NUMBER: 53

SUBJECT CODE: 2.2.1

TITLE: Cloud Chemistry Studies

PRINCIPAL INVESTIGATOR'S NAME: Dr. P. Summers, Dr. G. Isaac

AGENCY AND DEPARTMENT: Atmospheric Environment Service

ADDRESS: 4905 Dufferin Street
Downsview, Ontario
M3H 5T4

PHONE: (416) 667-4796
or
(416) 667-4683

COOPERATING AGENCIES AND INVESTIGATORS: National Aeronautical Establishment of NRC.
Ontario Ministry of Environment, Several U.S. Scientists.

DURATION OF EACH PHASE: On-going.

APPROXIMATE COST: 400K 82/83

OBJECTIVES: To obtain a better understanding of chemical and physical processes and pathways by which atmospheric pollutants contribute to acid precipitation and deposition.

METHOD: Detailed analyses are underway of aircraft observations taken by the NAE Twin Offer flights of air chemistry, cloud water and precipitation samples over North Bay, Ontario, during June 28 - July 29/82. Ground-based observations were taken in conjunction with these flights.

ANTICIPATED RESULTS: Understanding of the mechanisms and rates of removal of pollutants by clouds and precipitation, oxidation of acid precursor pollutants in clouds and precipitation, and the redistribution of pollutants through the troposphere by both precipitating and non-precipitating convection clouds.

SUBJECT CODE: 2.2.1

PROJECT NUMBER: 54

TITLE: Event Precipitation Chemistry Measurements - Port Hardy, Terrace, B.C.

PRINCIPAL INVESTIGATOR'S NAME: S. Nikleva

AGENCY AND DEPARTMENT: Atmospheric Environment Service

ADDRESS: Pacific Regional Offices
Vancouver, B.C.

PHONE:

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: April 1981 - March 1983

APPROXIMATE COST: 5.5K 82/83

OBJECTIVES: To collect event samples in addition to CANSAP at Port Hardy and Terrace, B.C. and to determine the magnitude of local effects.

METHOD: Precipitation samples for coastal CANSAP stations show evidence of local pollution sources. To evaluate the extent to which local sources may be a problem event samples are collected which can be related to specific air mass trajectories. Collection of samples will be done by AES staff at Port Hardy and Terrace. pH of each sample will be determined on site before sending the sample for analysis.

ANTICIPATED RESULTS: Report in Dec. 1982, of data and analysis.

PROJECT NUMBER: 55

SUBJECT CODE: 2.2.1

TITLE: Precipitation Chemistry Monitoring in the Northwest Territories

PRINCIPAL INVESTIGATOR'S NAME: A. S. Mann

AGENCY AND DEPARTMENT: Atmospheric Environment Service

ADDRESS: Western Regional Offices
Edmonton, Alberta

PHONE: (403) 437-1250

COOPERATING AGENCIES AND INVESTIGATORS: Government of NWT

DURATION OF EACH PHASE: On-going

APPROXIMATE COST: 6.0K 82/83

OBJECTIVES: To establish six additional monitoring sites to provide more complete background information in a very data sparse region.

METHOD: There are only three precipitation chemistry (CANSAP) sites in the NWT at Inuvik, Hay River and Fort Reliance. At six additional sites (Baker Lake, Contwayto, Coppermine, Cambridge Bay, Norman Wells and Fort Smith) samples will be collected on an event basis and analyzed for pH, conductivity and conventional WMO standard ions by commercial laboratory facilities in Edmonton. Where AES facilities are not available locally, services of GNWT may be utilized.

ANTICIPATED RESULTS: A better definition of the areal variability of acid rain. Data to verify models of acidic deposition in background areas of Canada.

SUBJECT CODE: 2.2.1

PROJECT NUMBER: 56

TITLE: Western Atlantic Ocean Experiment (WATOX)

PRINCIPAL INVESTIGATOR'S NAME: Dr. D. Whelpdale

AGENCY AND DEPARTMENT: Atmospheric Environment Service

ADDRESS:

PHONE: (416) 667-4903

COOPERATING AGENCIES AND INVESTIGATORS:
- Dr. J. N. Galloway
- University of Virginia - General Motors
- University of Delaware - NASA
- Bermuda Biological Station - NOAA

DURATION OF EACH PHASE: On-Going

APPROXIMATE COST: 20K 82/83

OBJECTIVES: To determine the flux and fate of pollutants from the North American continent over the western Atlantic Ocean.

METHOD: Information is to be gathered on (A) the amount of pollutants (i.e., 1. acids, 2. organics, and 3. metals) leaving the continent (and thus the amount staying), (B) the amount being deposited in the ocean, and (C) the amount available for inter-continental transport. Measurements are to be made on the North American east coast, at Bermuda, on cruise ships, and using aircraft in the study region. Fluxes and fates will be determined from meteorological analysis and modelling.

ANTICIPATED RESULTS: Immediate goals are the development of an advection climatology of the N.A. East Coast, and the integration of meteorological and preliminary pollutant data to obtain flux estimates.

PROJECT NUMBER: 57

SUBJECT CODE: 2.2.1

TITLE: Photochemical Model

PRINCIPAL INVESTIGATOR'S NAME: Anda Kuksis Kalvins

AGENCY AND DEPARTMENT: Ontario Hydro, Research Division

ADDRESS: 800 Kipling Avenue
Toronto, Ontario
M8Z 5S4

PHONE: 231-4111
Ext. 7053

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: Phase 1 - December 1981 to October 1982
Phase 2 - October 1982 to December 1983

APPROXIMATE COST: $40,000

OBJECTIVES: To select/develop a photochemical model which can be used to simulate the reactions of the emissions from Ontario Hydro's fossil fuel fired generating stations.

METHOD: (a) Literature review of atmospheric photochemistry and the photochemical models which have been reported to describe the reactions of atmospheric pollutants. (b) Selection and modification of an existing photochemical model, e.g., addition and/or grouping of chemical species and their reactions. (c) Testing of the mechanism with emissions data and the data collected during field studies of fossil fuel fired power station plumes. (d) Incorporation of a plume dispersion model into the photochemical model. The photochemical model describes the changes in the concentrations of the emissions and newly-formed chemical species as a result of chemical reactions within the plume. A plume dispersion model is required to account for the changes which occur as the plume travels downwind and is dispersed by winds, etc.

ANTICIPATED RESULTS: A photochemical model which can serve as one of the many tools which are required to acquire a detailed understanding of the impact of Ontario Hydro's fossil fuel fired generating station emissions on the environment.

SUBJECT CODE: 2.2.2

PROJECT NUMBER: 58

TITLE: Studies of Atmospheric Nitrogen Compounds

PRINCIPAL INVESTIGATOR'S NAME: Dr. A. Wiebe

AGENCY AND DEPARTMENT: Atmospheric Environment Service

ADDRESS: 4905 Dufferin Street
Downsview, Ontario
M3H 5T4

PHONE: (416) 667-4797

COOPERATING AGENCIES AND INVESTIGATORS: Dr. K. Anlauf (AES)
P. Fellin (AES)
Concord Scientific Corp.

DURATION OF EACH PHASE: April 1982 - March 1983
Nanticoke field study: June 1 - 15, 1982
North Bay field study: June 28 - July 29/82

APPROXIMATE COST: 18.5K

OBJECTIVES: The evaluation of measurement techniques for atmospheric nitrogen compounds as they relate to atmospheric acidic deposition and transport.

METHOD: Development of methodologies for the measurement of atmospheric compounds has been in progress for two years and methods have been established for the measurement of NH_3, HNO_3 and NO_3 particulate. Measurement systems for atmospheric nitrogen compounds have been developed in-house and under contract for measurement of selected atmospheric nitrogen compounds.

ANTICIPATED RESULTS: Measurement systems will be evaluated fully by the end of the current fiscal year. The sample analyses and preliminary report of the results and intercomparison of measurements taken at two field studies (Nanticoke and North Bay) will be completed by March 31, 1983.

PROJECT NUMBER: 59

SUBJECT CODE: 2.2.2

TITLE: NO_X Study

PRINCIPAL INVESTIGATOR'S NAME: Dr. K. Anlauf

AGENCY AND DEPARTMENT: Atmospheric Environment Service

ADDRESS: 4905 Dufferin Street
Downsview, Ontario
M3H 5T4

PHONE: (416) 667-4794

COOPERATING AGENCIES AND INVESTIGATORS: Unisearch Inc.,
Toronto, Ontario

DURATION OF EACH PHASE: April/82 - March/83

APPROXIMATE COST: 5.0K

OBJECTIVES: To measure HNO_3 and NO_2 in the field (at Nanticoke).

METHOD: A diode laser system from Unisearch Inc., was rented for the period June 1 - 14, 1982 and used during the Nanticoke field study to measure HNO_3 and NO_2 concentrations. An intercomparison is to be made with filterpack measurements.

ANTICIPATED RESULTS: A complete analysis of sampling results. Average concentrations to be published.

SUBJECT CODE: 2.2.3

PROJECT NUMBER: 60

TITLE: Oxidant Model

PRINCIPAL INVESTIGATOR'S NAME: Dr. J. Bottenheim

AGENCY AND DEPARTMENT: Atmospheric Environment Service, Environment Canada

ADDRESS: 4905 Dufferin Street
Downsview, Ontario
M3H 5T4

PHONE: (416) 667-4778

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: April 1983 - March 1984 (tentative)

APPROXIMATE COST: 15.0K 83/84

OBJECTIVES: To develop a model describing chemistry involved in formation and transport of oxidants (mainly ozone and PAN).

METHOD: The oxidant model is to be designed to allow for oxidant control strategies (diagnostic modelling) as well as to enable forecasting of oxidant episodes (prognostic modelling). The shape and type of model to be developed will be specified after literature studies and a planning workshop.

ANTICIPATED RESULTS: The ultimate goal is to obtain an understanding of the occurrence of elevated oxidant levels, their origin, and ways of transport, and to incorporate this information in practical modelling applications.

PROJECT NUMBER: 61

SUBJECT CODE: 2.2.3

TITLE: Natural Sources of Ozone

PRINCIPAL INVESTIGATOR'S NAME: Dr. Y. S. Chung

AGENCY AND DEPARTMENT: Atmospheric Environment Service

ADDRESS: 4905 Dufferin Street
Downsview, Ontario
M5H 5T4

PHONE: (416) 667-4980

COOPERATING AGENCIES AND INVESTIGATORS: EPS

DURATION OF EACH PHASE: April 1982 - March 1983

APPROXIMATE COST: 0.5K

OBJECTIVES: To review the role of natural ozone sources and to assess the importance of ozone transport to ground level.

METHOD: Literature review, data collection and analysis, interpretation.

ANTICIPATED RESULTS: Determination of the fraction of observed ozone due to natural sources (in particular stratospheric injection). Final report to be given.

SUBJECT CODE: 2.2.3

PROJECT NUMBER: 62

TITLE: Oxidant Climatology

PRINCIPAL INVESTIGATOR'S NAME: E. I. Mukammal

AGENCY AND DEPARTMENT: Atmospheric Environment Service

ADDRESS: 4905 Dufferin Street
Downsview, Ontario
M3H 5T4

PHONE: (416) 667-4641

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: To March 1984.

APPROXIMATE COST: 20.0K 82/83

OBJECTIVES: To determine the frequency, intensities and duration of ozone episodes.

METHOD: The type and frequency of meteorological conditions associated with high ozone concentrations will be examined for characteristic regions of Canada, taking into consideration local effects and advection. Meteorological conditions during statistical episodes are to be assessed.

ANTICIPATED RESULTS: An assessment of Canadian regions having potential ozone formation at concentration levels of concern. A preliminary summary of Ontario climatology will be developed by September 1983. A descriptive analysis of the synoptic climatology of Quebec region will be completed by March 1984.

PROJECT NUMBER: 63

SUBJECT CODE: 2.2.3

TITLE: Determination of Trends in Particulate Sulphate Concentrations at Selected NAPS Stations (1970-1979)

PRINCIPAL INVESTIGATOR'S NAME: Roger Lafleur, Head, Ambient Monitoring

AGENCY AND DEPARTMENT: Environment Canada

ADDRESS: Environment Protection Service
Air Pollution Control Directorate
Pollution Measurement Division
A.P.T.C., River Road
Ottawa, Ontario K1A 1C8

PHONE: (613) 998-4705

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: 1970-1979

APPROXIMATE COST: $40,000 (81-82)

OBJECTIVES: To determine trends in particulate sulphate concentrations as measured by high volume samplers of selected NAPS stations in Canada.

METHOD: Archived filter samplers (1970 to 1979) from ten stations in the NAPS network were analyzed for particulate sulphate under contract. The results were compiled and interpreted.

ANTICIPATED RESULTS: A report was published (82) and is available from above address.

SUBJECT CODE: 2.2.3

PROJECT NUMBER: 64

TITLE: New Brunswick - Nova Scotia
Oxidants Study - Air Quality Analysis

PRINCIPAL INVESTIGATOR'S NAME: Thomas Dann, Project Co-ordinator,
Air Pollution Measurement

AGENCY AND DEPARTMENT: Environment Canada

ADDRESS: Environment Protection Service
Air Pollution Control Directorate
Pollution Measurement Division
A.P.T.C., River Road
Ottawa, Ontario K1A 1C8

PHONE: (613) 998-4705

COOPERATING AGENCIES AND INVESTIGATORS: New Brunswick Department of Environment
Nova Scotia Department of Environment
Atmospheric Environment Service

DURATION OF EACH PHASE: Contract to be initiated by September 1982.
Work to be completed by March 31, 1983.

APPROXIMATE COST: $30,000 (82-83)

OBJECTIVES: To assess the impact of long range transport on air quality in the region, to characterize the prevailing synoptic scale meteorological conditions during ozone episodes, to determine the relationship between sulphate concentrations and ozone and to assess the effect of Saint John and Halifax precursor emissions on local and downwind ozone concentrations.

METHOD: Existing air quality, meteorological and inventory data will be assembled and analyzed under contract. No field work involved.

ANTICIPATED RESULTS: The study will form part of the assessment phase of EPS's oxidants control program. The results will be used to assess the adequacy of present monitoring and inventory efforts and determine the need for control actions.

PROJECT NUMBER: 65

SUBJECT CODE: 2.2.3

TITLE: Vancouver Oxidants Study - Air Quality Analysis

PRINCIPAL INVESTIGATOR'S NAME: Thomas Dann, Project Co-Ordinator, Air Pollution Measurement

AGENCY AND DEPARTMENT: Environment Canada

ADDRESS: Environment Protection Service
Air Pollution Control Directorate
Pollution Measurement Division
A.P.T.C., River Road
Ottawa, Ontario K1A 1C8

PHONE: (613) 998-4705

COOPERATING AGENCIES AND INVESTIGATORS: Greater Vancouver Regional District
B.C. Environment
Atmospheric Environment Service

DURATION OF EACH PHASE: Work carried out under contract during 81-82

APPROXIMATE COST: $40,000 (81-82)

OBJECTIVES: To determine effect of local emissions and long range transport on elevated ozone levels in the area. To gain an understanding of the possible downwind effects of Vancouver emissions on sensitive Fraser Valley crops, characteristic meteorological conditions during ozone episodes, and the relative roles of nitrogen oxides and volatile organics in the formation of ozone.

METHOD: Existing air quality, meteorological and inventory data was assembled and analyzed under contract.

ANTICIPATED RESULTS: The study will be used to assess the significance of measured high ozone levels in the Vancouver area and will be the first phase in the development of a control strategy for Vancouver. A computerized data archive will be established which can be made available to other researchers.

SUBJECT CODE: 2.2.3

PROJECT NUMBER: 66

TITLE: Montreal - Quebec City Oxidants Study - Air Quality Analysis

PRINCIPAL INVESTIGATOR'S NAME: Thomas Dann, Project Co-ordinator
Air Pollution Measurement

AGENCY AND DEPARTMENT: Environment Canada

ADDRESS: Environment Protection Service
Air Pollution Control Directorate
Pollution Measurement Division
A.P.T.C., River Road
Ottawa, Ontario K1A 1C8

PHONE: (613) 998-4705

COOPERATING AGENCIES AND INVESTIGATORS:
Montreal Urban Community
Environment Quebec
Atmospheric Environment Service

DURATION OF EACH PHASE: Contract to be initiated September 1982. Work to be completed by March 31, 1983.

APPROXIMATE COST: $60,000 (82-83)

OBJECTIVES: To determine if elevated ozone levels in the Montreal area result solely from local emissions or from a combination of local emissions plus long range transport. To gain an understanding of the distribution of ozone in the area, the possible downwind effects of Montreal emissions on Quebec City and sensitive crop species along the St. Lawrence, the characteristic meso and synoptic scale meteorological conditions resulting in high ozone levels and the expected frequency of such conditions, the regional nature of ozone episodes, the roles of nitrogen oxides and volatile organic compounds in the formation of ozone and the relationship between sulphate and ozone concentrations during episodes.

METHOD: Existing air quality, meteorological and inventory data will be assembled and analyzed under contract. No field work involved.

ANTICIPATED RESULTS: The study will form part of the assessment phase of EPS's oxidants control program. The results will be used to assess the adequacy of present monitoring and inventory efforts and determine the need for control actions.

PROJECT NUMBER: 67

SUBJECT CODE: 2.2.4

TITRE: Composition chimique des aérosols et le transport des polluants sur les grandes distances

NOM DU CHERCHEUR RESPONSABLE: Lubomir Zikovsky

MINISTÈRE, ORGANISME OU ORGANISME PRIVÉ, SERVICE: Environnement Canada

ADRESSE: Ecole Polytechnique
Institut de génie nucléaire
C.P. 6079, Succ. "A"
Montréal, Québec
H3C 3A7

TÉLÉPHONE: (514) 344-4706

COLLABORATEUR(S), ORGANISME(S) ET CHERCHEUR(S):

DURÉE DE CHAQUE PHASE: 3 ans

COÛT APPROXIMATIF: $60K

OBJECTIFS DE TRAVAIL: Mesurer les concentrations des éléments dans les polluants atmosphériques à un endroit qui est éloigné des sources de la pollution et qui se trouve à une haute altitude.

Enregistrer les conditions atmosphériques qui existent au cours des prélèvements.

Etudier les corrélations qui pourraient exister entre la composition chimique des polluants, les conditions atmosphériques et le transport sur les longues distances.

MÉTHODE DE TRAVAIL: Il a été suggéré par plusieurs chercheurs qu'il existe une corrélation entre les rapports de certains éléments (p.e. Mn et V), que l'on trouve dans les aérosols et les sources de la pollution atmosphérique. Si une telle corrélation existe, il serait possible d'étudier le transport des polluants à longues distances en utilisant la composition chimique comme indicateur de leur origine.

RÉSULTATS PRÉVUS:

SUBJECT CODE: 2.2.4

PROJECT NUMBER: 68

TITLE: Coastal Acid Precipitation Study

PRINCIPAL INVESTIGATOR'S NAME: M. S. Kotturi

AGENCY AND DEPARTMENT: Ministry of Environment/Air Studies Branch

ADDRESS: Air Studies Branch
Ministry of Environment
Parliament Buildings
Victoria, B.C.
V8V 1X5

PHONE: (604) 387-5888

COOPERATING AGENCIES AND INVESTIGATORS: AES/S. Nikleva

DURATION OF EACH PHASE: 09/80 to 04/83

APPROXIMATE COST: $5,000

OBJECTIVES: The British Columbia Ministry of Environment operates three stations along the coast to obtain coastal precipitation acidity data.

METHOD: Precipitation samples are collected on event basis using manual collector, using a funnel and bottle collection system. Analysis of SO_4, NO_3, F, Cl, PO_4, K, Ca, Mg, pH, total and strong acidity will be made.

ANTICIPATED RESULTS: Data will illustrate British Columbia coastal background acidity of precipitation.

PROJECT NUMBER: 69

SUBJECT CODE: 2.3.1

TITLE: Preliminary Experiments on Nucleating Properties of Sulfate and Nitrate Particulates

PRINCIPAL INVESTIGATOR'S NAME: P. J. Denison

AGENCY AND DEPARTMENT: Acres Consulting Services Limited

ADDRESS: 5259 Dorchester Road
P.O. Box 1001
Niagara Falls, Ontario
L2E 6W1

PHONE: (416) 354-3831

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: June 1982 - Feb 1983

APPROXIMATE COST:

OBJECTIVES: To determine the in-cloud nucleating properties of sulfate and nitrate aerosol particulates and their role in determining the chemical composition of precipitation.

METHOD: A series of on-going laboratory experiments are being conducted to determine the interaction of sulfate and nitrate particulates with cloud droplets. A mixing type cloud chamber is used to contain a supercooled cloud held at a fixed temperature. Several commonly occurring sulfate and nitrate compounds are introduced as a smoke or fine dust into the cloud chamber to determine the threshold nucleating temperature for each compound. Differences in the nucleating temperatures provides direct information on the ability of various compounds in initiating ice crystal formation (and subsequently precipitation) in supercooled clouds. The results of these experiments may suggest mechanisms responsible for widely varying sulfate and nitrate ratios which have been reported in eastern Canada and U.S. Furthermore, the results could also indicate the enhancement of precipitation frequency as a result of the presence of atmospheric sulfate and nitrate particles.

ANTICIPATED RESULTS:

SUBJECT CODE: 2.3.1

PROJECT NUMBER: 70

TITLE: Precipitation Monitoring Network, Northern Saskatchewan

PRINCIPAL INVESTIGATOR'S NAME: Mr. L. Lechner

AGENCY AND DEPARTMENT: Saskatchewan Environment

ADDRESS: 5th Floor
1855 Victoria Avenue
Regina, Saskatchewan
S4N 3V5

PHONE: (306) 565-6195

COOPERATING AGENCIES AND INVESTIGATORS: Saskatchewan Research Council
Analytical Laboratory
30 Campus Drive
Saskatoon, Saskatchewan S7N 0X1

DURATION OF EACH PHASE: July 1 to October 31, 1982

APPROXIMATE COST: $15,000

OBJECTIVES: To monitor wet deposition on an event basis at 5 stations in Northern Saskatchewan.

METHOD:

a) Collection of wet samples using a manual collector.

b) Samples to be collected on an event basis.

c) Sampling locations:
- Stoney Rapids
- La Loche
- Pelican Narrows
- Dreaver Lake
- Kane Lake

ANTICIPATED RESULTS: To determine the chemical composition of wet deposited materials in Northern Saskatchewan.

PROJECT NUMBER: 71

SUBJECT CODE: 2.3.1

TITLE: The Scavenging of Airborne Pollutants by Clouds

PRINCIPAL INVESTIGATOR'S NAME: E. P. Lozowski

AGENCY AND DEPARTMENT: AES/Air Quality Research Branch/Ice Centre

ADDRESS: Ice Centre
Environment Canada
Ottawa, Ontario
K1A 0H3

PHONE: (613) 995-6776

COOPERATING AGENCIES AND INVESTIGATORS: University of Alberta, K. Finstad.

DURATION OF EACH PHASE: 01/82 - 12/82

APPROXIMATE COST: $35,500

OBJECTIVES:

1. Prepare a review of precipitation scavenging literature.
2. Modelling relevant to precipitation scavenging by convective clouds
3. Analysis of aircraft data relevant to precipitation scavenging by convective clouds.

METHOD:

1. Simple analytical models are devised to describe the time evolution of the frequency distribution of pollutant concentration as a result of precipitation scavenging.
2. Aircraft measurements of the spatial variability of pollutant concentrations are compared with the model predictions.

ANTICIPATED RESULTS: A way of incorporating certain sub-grid scale scavenging effects into Lagrangian or Eulerian LRTAP models.

SUBJECT CODE: 2.3.1

PROJECT NUMBER: 72

TITLE: Examination of Relationships between Local Industrial Emissions and Chemical Composition of Rainwater

PRINCIPAL INVESTIGATOR'S NAME: Dr. A. S. Reid

AGENCY AND DEPARTMENT: Alcan Smelters and Chemicals Ltd.

ADDRESS: P.O. Box 1800
Kitimat, B.C.
V8C 2H2

PHONE: (604) 632-3111

COOPERATING AGENCIES AND INVESTIGATORS: Air Management Branch
B.C. MOE
M. S. Kotturi

DURATION OF EACH PHASE: July to December 1982

APPROXIMATE COST: $5,000 to December 1982

OBJECTIVES:
a) To collect samples from two storms per season and analyse for acidity, pH, NO_3^-, SO_4^{-2}, F^-, Cl^-.

b) To collect 2 - 4 samples per month and analyse for pH.

METHOD:
a) Samples will be collected at one site by means of a Sangamo precipitation collector, Type A.

b) Analysis will be carried out by the Alcan Kitimat Laboratory. Some may be done at the Environmental Laboratory, Ministry of Environment.

ANTICIPATED RESULTS: Data will be supplied to the Air Management Branch, MOE, for inclusion in their more extensive program.

PROJECT NUMBER: 73

SUBJECT CODE: 2.3.1

TITLE: Cloud/Pollutant Interactions

PRINCIPAL INVESTIGATOR'S NAME: O. T. Melo

AGENCY AND DEPARTMENT: Ontario Hydro Research Division

ADDRESS: 800 Kipling Avenue
Toronto, Ontario
M8Z 5S4

PHONE: (416) 231-4111

COOPERATING AGENCIES AND INVESTIGATORS:
A.C. McMillan)
J. Grabenstetter)- Ontario Hydro
G. Ogram)

R.U. Cho)-University of Toronto
J.R. Iribarne)

Partial funding by CEA

DURATION OF EACH PHASE: Phase 1, complete August 1983

APPROXIMATE COST: Phase 1 - $57,500

OBJECTIVES:
(1) To investigate the role of cloud/pollutant interactions in the transport of pollutants.

(2) To integrate understanding of micro- and meso- and large-scale processes into long range transport modelling.

METHOD:
- Survey of cloud type and dynamics and their effect on vertical transport of pollutants.
- Survey of extent of knowledge of microprocesses (uptake by atmospheric water, chemical transformation, etc).
- Development of models describing effects of clouds on pollutant transport, transformation and removal.

ANTICIPATED RESULTS: Improved understanding and treatment of cloud/pollutant interactions (wet processes) in long range transport modelling.

SUBJECT CODE: 2.3.1

PROJECT NUMBER: 74

TITLE: Precipitation Scavenging

PRINCIPAL INVESTIGATOR'S NAME: Dr. L. A. Barrie

AGENCY AND DEPARTMENT: Atmospheric Environment Service

ADDRESS: 4905 Dufferin Street
Downsview, Ontario
M3H 5T4

PHONE: (416) 667-4785

COOPERATING AGENCIES AND INVESTIGATORS: Professor J. Iribarne
University of Toronto

DURATION OF EACH PHASE: Completion September 1982

APPROXIMATE COST: 14.9K

OBJECTIVES: To investigate precipitation scavenging processes, both theoretically and experimentally.

METHOD: Retention and oxidation of dissolved SO_2 when supercooled water drops freeze are being analyzed in an experimental investigation of SO_2 scavenging by rimed snowstorms, using single droplets. Scavenging of gases and particulates will be studied using APN data. Parameterizations of precipitation scavenging processes suitable for LRTAP models will be investigated.

ANTICIPATED RESULTS: This study will provide a better understanding of important processes that result in atmospheric sulphur dioxide being efficiently scavenged by winter storms.

PROJECT NUMBER: 75

SUBJECT CODE: 2.3.1

TITLE: Sulphur Dioxide in Precipitation

PRINCIPAL INVESTIGATOR'S NAME: Dr. L. A. Barrie

AGENCY AND DEPARTMENT: Atmospheric Environment Service

ADDRESS: 4905 Dufferin Street
Downsview, Ontario
M3H 5T4

PHONE: (416) 667-4785

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: To March 1983.

APPROXIMATE COST: 22.5K

OBJECTIVES: To investigate the occurrence of sulphur dioxide in precipitation at a rural location in eastern Canada.

METHOD: Dissolved SO_2, sulphate, acidity and nitrates in precipitation is measured during a two to three month period in late fall or early winter with simultaneous measurement of the concentration of SO_2, sulphate and nitrate in air.

ANTICIPATED RESULTS: The study will provide important information on the frequency of occurrence of dissolved sulphur dioxide, the most toxic form of sulphur in solution, in precipitation and hence a more detailed insight to the scavenging process.

SUBJECT CODE: 2.3.1

PROJECT NUMBER: 76

TITLE: Precipitation Chemistry from Rain Samples Collected by Ship in the North Atlantic

PRINCIPAL INVESTIGATOR'S NAME: B. L. Taylor

AGENCY AND DEPARTMENT: Atmospheric Environment Service

ADDRESS: Field Services Directorate
Atlantic Regional Offices
Halifax, N.S.

PHONE: (902) 835-9529

COOPERATING AGENCIES AND INVESTIGATORS: J. Elliott
Bedford Institute of Oceanography (BIO)

DURATION OF EACH PHASE: Estimated April 1982 - March 1984.

APPROXIMATE COST:

OBJECTIVES: To extend the LRTAP analysis out over the North Atlantic for a number of specific cases in order to corroborate the seaward distribution of contaminants in rain that is being inferred from land stations.

METHOD: The distribution of chemical species over land and ocean is analyzed using BIO ship data and data from land stations. Rain samples are collected at sea using a sampling method developed for BIO ships. U.S. land network MAP35 is used in the preliminary assessment of the distribution of eastern North American stations.

ANTICIPATED RESULTS: An analysis of precipitation chemistry characteristics of individual storms along their land to ocean trajectories.

PROJECT NUMBER: 77

SUBJECT CODE: 2.3.1

TITLE: Precipitation Chemistry of the Pacific Coast

PRINCIPAL INVESTIGATOR'S NAME: Dr. G. A. McBean

AGENCY AND DEPARTMENT: Atmospheric Environment Service

ADDRESS: Institute of Ocean Sciences
Sydney, B.C.

PHONE: (604) 656-8448

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: On-going

APPROXIMATE COST: 23.2K 82/83

OBJECTIVES: To investigate the chemistry of precipitation in Pacific coastal areas and to understand the reasons for its composition.

METHOD: There are four parts to the study:

1. Collection of rain samples from ships at sea.
2. Collection of snow samples on coastal mountains including Mt. Washington and by helicopter.
3. Coordination of coastal APN station.
4. Scientific interpretation of data.

ANTICIPATED RESULTS: Report describing the survey procedure and results will be published.

SUBJECT CODE: 2.3.2

PROJECT NUMBER: 78

TITLE: Dry Deposition Research

PRINCIPAL INVESTIGATOR'S NAME: G. C. Edwards and G. L. Ogram

AGENCY AND DEPARTMENT: Ontario Hydro Research Division

ADDRESS: 800 Kipling Avenue
Toronto, Ontario
M8Z 5S4

PHONE: (416) 231-4111

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: June, 1984 to May, 1986.

APPROXIMATE COST:

OBJECTIVES:

1. Measure rate of dry deposition of important atmospheric acidic pollutants (SO_2, NO, NO_2, and HNO_3) to surfaces characteristic of Ontario and eastern Canada, and
2. Develop a mathematical model of the dry deposition process.

METHOD: An instrument package is being assembled and tested with partial funding from the Canadian Electrical Association. Once developed, the package will allow us to make pollutant measurements at one level by means of a sensitive and versatile tunable diode laser spectrometer and winds, temperature and humidity at three levels near the surface. The package will be used to study a representative series of pollutant/surface/meteorological conditions combinations in Ontario and eastern Canada (if CEA funding is made available) so that a mathematical model of the dry deposition process may be developed. It is hoped to use the package to quantify dry deposition fluxes to calibrated watersheds.

ANTICIPATED RESULTS:

NUMÉRO DE PROJET: 79

CODE DU SUJET: 3.2

TITRE: Les dépôts secs des oxydes d'azote

NOM DU CHERCHEUR RESPONSABLE: Conrad East

MINISTÈRE, ORGANISME OU ORGANISME PRIVÉ, SERVICE: Université du Québec à Montréal

ADRESSE: Centre de Recherches en Sciences de l'Environnement
B.P. 8888, Succ "A"
Montréal, Québec
H3C 3P8

TÉLÉPHONE: (514) 282-3302

COLLABORATEUR(S), ORGANISME(S) ET CHERCHEUR(S): J. Dionne, Université du Québec à Rimouski
P. Schuepp, MacDonald Collège
P. Lavallée, Université du Québec à Montréal

DURÉE DE CHAQUE PHASE: (1981-84)

COÛT APPROXIMATIF: $15,000 (1982-83)

OBJECTIFS DE TRAVAIL: Mesurer les dépôts secs des oxydes d'azote sur diverses surfaces: neige, sol nu, végétation.

MÉTHODE DE TRAVAIL: Méthode des profils des concentrations sur une tour de dix (10) mètres.

RÉSULTATS PRÉVUS: Vitesse de dépôt des polluants pour diverses conditions de surface, de vent et de stabilité.

CODE DU SUJET: 2.3.2

NUMÉRO DE PROJET: 80

TITRE: Transfert par turbulence d'un polluant gazeux sur le couche nivale

NOM DU CHERCHEUR RESPONSABLE: Conrad East

MINISTÈRE, ORGANISME OU ORGANISME PRIVÉ, SERVICE: Centre de recherche en sciences de l'environnement (CERSE) Université du Québec à Montréal (UQAM)

ADRESSE: C.P. 8888, Succ. "A"
Montréal, Québec
H3C 3P8

TÉLÉPHONE: (514) 282-3302

COLLABORATEUR(S), ORGANISME(S) ET CHERCHEUR(S): Université du Québec à Rimouski, Jacques Dionne
Collège Mac Donald, Peter Schuepp

DURÉE DE CHAQUE PHASE:
1. 1981-82
2. 1982-83
3. 1983-84

COÛT APPROXIMATIF: 1981-82 ($25,000) 1982-83 ($15,000) 1983-84 ($15,000)

OBJECTIFS DE TRAVAIL: Mesurer les transferts par turbulence des oxydes d'azote sur diverses surfaces, en particulier sur la neige.

MÉTHODE DE TRAVAIL: Méthode des profils avec tour de 10 mètres, mesurant les concentrations, la température et le vent à trois niveaux.

RÉSULTATS PRÉVUS: Taux de transfert du polluant sur la surface dans diverses conditions de stabilité atmosphérique.

PROJECT NUMBER: 81

SUBJECT CODE: 2.3.2

TITLE: Evaluation of Non-Continuous Methods for the Measurement of Particulate Nitrate and Nitric Acid

PRINCIPAL INVESTIGATOR'S NAME: Thomas Dann, Project Co-ordinator
Air Pollution Measurement

AGENCY AND DEPARTMENT: Environment Canada

ADDRESS: Environment Protection Service
Air Pollution Control Directorate
Pollution Measurement Division
A.P.T.C. River Road
Ottawa, Ontario K1A 1C8

PHONE: (613) 998-4705

COOPERATING AGENCIES AND INVESTIGATORS: J. Durham, U.S. EPA
Atmospheric Environment Service (July 1982)

DURATION OF EACH PHASE: Contract literature review (81-82)
Participation in field evaluation (July 1982)

APPROXIMATE COST: $20,000 (81-82) $13,000 (82-83)

OBJECTIVES: To evaluate available non-continuous sampling methods for particulate nitrates and nitric acid and develop a methodology suitable for application to the NAPS Network.

METHOD: An in depth review of diffusion denuder/filter pack methods for measuring nitric acid and particulate nitrates was performed under contract. A promising design developed by J. Durham of the U.S. EPA was evaluated in the field in co-operation with an AES intercomparison study of continuous and non-continuous methods for measuring nitric acid.

ANTICIPATED RESULTS: Development of practical and accurate field sampling methodology for particulate nitrates and nitric acid that is suitable for Canadian climatic extremes.

SUBJECT CODE: 2.3.2

PROJECT NUMBER: 82

TITLE: Dry-deposition of Submicron-size Aerosol to Coniferous and Lichen Foliage

PRINCIPAL INVESTIGATOR'S NAME: Peter H. Schuepp

AGENCY AND DEPARTMENT: Macdonald Campus of McGill University, Dept. of Agric. Chemistry and Physics

ADDRESS: 21'111 Lakeshore Road
Ste. Anne-de-Bellevue, Quebec
H9X 1C0

PHONE: (514) 457-2000 Ext. 212

COOPERATING AGENCIES AND INVESTIGATORS: (Funded by NSERC and partially by AES)

DURATION OF EACH PHASE: 04/82 to 03/83

APPROXIMATE COST: $3,000

OBJECTIVES: To determine deposition velocities of submicron-size aerosol at low flow velocities to coniferous and lichen foliage. To evaluate the conceptual and analytical models that have been proposed to describe such transfer.

METHOD: To measure ionic mass transfer to nickel-plated samples of such foliage under conditions of Sc and Re-similarity (similarity of molecular diffusivities and fluid flow).

To use various conceptual and analytical models to interpret the results and to derive - from the degree of agreement between observation and model prediction - some conclusions about the validity of the models.

ANTICIPATED RESULTS: Better predictions of deposition rates with distance in coniferous stands and to lichen-covered surfaces.

PROJECT NUMBER: 83

SUBJECT CODE: 2.3.2

TITLE: Filter Evaluation Project for Particulate Sulphates

PRINCIPAL INVESTIGATOR'S NAME: Thomas Dann, Project Co-ordinator, Air Pollution Measurement

AGENCY AND DEPARTMENT: Environment Canada

ADDRESS: Environment Protection Service
Air Pollution Control Directorate
Pollution Measurement Division
A.P.T.C., River Road
Ottawa, Ontario K1A 1C8

PHONE: (613) 998-4705

COOPERATING AGENCIES AND INVESTIGATORS: Provincial and Municipal Air Pollution Agencies in Canada

DURATION OF EACH PHASE: January - March 1981
July 1981 - December 1982

APPROXIMATE COST: N/A

OBJECTIVES: (1) To evaluate available sampling media and analytical methods for particulate sulphate determinations made using hi-volume samplers, (2) to evaluate the practicality of using teflon coated glass fibre filter media in the field, (3) to compare sulphate data from three techniques Hi-Vol/Glass Fibre Filter, Hi-Vol/Teflon Coated Glass Fibre Filter, Dichotomous/Teflon Filter.

METHOD: Co-located samplers of the three types are operated in Halifax, Montreal, Toronto, Ottawa, Winnipeg, Edmonton, and Vancouver. Collected samples are analyzed for particulate sulphate. A contract literature review of available sampling and analytical methods for particulate sulphates was performed.

ANTICIPATED RESULTS: Improved sampling methods for particulate sulphate for use in the NAPS network. A report on literature review (1981) and reports on field comparison study are available from above address.

SUBJECT CODE: 2.3.2

PROJECT NUMBER: 84

TITLE: National Air Pollution Surveillance (NAPS) Special Sulphate and Nitrate Studies 1975, 1976 and 1979.

PRINCIPAL INVESTIGATOR'S NAME: Roger J. Lafleur, Head, Ambient Monitoring Section

AGENCY AND DEPARTMENT: Environment Canada

ADDRESS: Environment Protection Service
Air Pollution Control Directorate
Pollution Measurement Division
Ottawa, Ontario
K1A 1C8

PHONE: (613) 998-4705

COOPERATING AGENCIES AND INVESTIGATORS: All provincial departments of the Environment and Environment Canada

DURATION OF EACH PHASE:
a) 18/4/75 to 30/5/75
b) 29/7/76 to 28/8/76
c) 26/7/79 to 11/11/79

APPROXIMATE COST: Not available

OBJECTIVES: To determine ambient air quality levels of particulate sulphates and nitrates across Canada.

METHOD: The 110 high volume samplers at NAPS Stations across Canada routinely collect total suspended particulate matter every 6th day. This network has been in operation since 1970. On three separate occasions, special studies were carried out during which the collected particulate matter was also analysed for sulphates and nitrates.

ANTICIPATED RESULTS: Three separate reports published:
- 1975
- 1976
- 1979

Available from Environment Canada (Above Address.)

PROJECT NUMBER: 85

SUBJECT CODE: 2.3.2

TITLE: Fine Particulate Concentrations in Canadian Urban Areas

PRINCIPAL INVESTIGATOR'S NAME: Thomas Dann, Project Co-ordinator, Air Pollution Measurement

AGENCY AND DEPARTMENT: Environment Canada

ADDRESS: Environmental Protection Service
Air Pollution Control Directorate
Pollution Measurement Division
A.P.T.C., River Road
Ottawa, Ontario K1A 1C8

PHONE: (613) 998-4705

COOPERATING AGENCIES AND INVESTIGATORS: Provincial and Municipal Air Pollution Agencies in Canada

DURATION OF EACH PHASE: September 1980 - January 1981
July 1981 - Ongoing

APPROXIMATE COST: $105,000 (80-81) 81-82 cost breakdown not available

OBJECTIVES: To determine concentrations of selected fine particulate contaminants in Canadian urban areas. To determine relationship between fine particulates and total suspended particulates. To evaluate sampling and analytical methods for fine particulate air contaminants.

METHOD: Dichotomous samplers are operated on a six day schedule in Halifax, Montreal, Toronto, Ottawa, Winnipeg, Edmonton, and Vancouver. Samples are analyzed for mass, sulphate, nitrate, lead, arsenic (some for cadmium and chromium) in two size fractions, $D < 2.5$ um and $2.5 \text{ um} < D < 15$ um. In 1980 an evaluation of analytical methods was carried out.

ANTICIPATED RESULTS: Establishment of data base on fine particulate concentrations in Canada. Selection of replacement monitoring and analytical methods for particulate pollutants. Two reports published - 1981 and 1982 available from above address. Third report available by November, 1982.

SUBJECT CODE: 2.3.2

PROJECT NUMBER: 86

TITLE: The Development of an Instrument Package to Measure Dry Deposition Processes

PRINCIPAL INVESTIGATOR'S NAME: G. C. Edwards, G. L. Ogram

AGENCY AND DEPARTMENT: Ontario Hydro Research Division

ADDRESS: 800 Kipling Avenue
Toronto, Ontario
M8Z 5S4

PHONE: (416) 231-4111

COOPERATING AGENCIES AND INVESTIGATORS: Funding received from the Canadian Electrical Association

DURATION OF EACH PHASE: 2 Years (05/82 - 05/84)

APPROXIMATE COST: $278,000

OBJECTIVES: To develop an instrumental package for the "in-field" measurement of net vertical fluxes of various pollutants by means of the eddy correlation technique.

METHOD: The fluctuations in the concentrations of various gaseous pollutants will be measured with fast response and high sensitivity by a tunable diode laser absorption spectrometer. Micrometeorological parameters will be measured using sonic anemometers, Lyman-Alpha Hygrometers, hot film sensors, micro-bead thermistors, etc.

ANTICIPATED RESULTS: An instrument system capable of characterizing dry deposition fluxes by eddy correlation techniques.

PROJECT NUMBER: 87

SUBJECT CODE: 2.3.2

TITLE: Dry Deposition Measurement Techniques Intercomparison Study at Champaign, Illinois

PRINCIPAL INVESTIGATOR'S NAME: Dr. Walter Chan

AGENCY AND DEPARTMENT: Ontario Ministry of the Environment
Air Resources Branch

ADDRESS: 880 Bay Street, 4th Floor
Toronto, Ontario
M5S 1Z8

PHONE: (416) 965-1634

COOPERATING AGENCIES AND INVESTIGATORS:

Sponsor agency:
Illinois State Water Survey (ISWS)
605 E. Springfield Avenue
Champaign, Illinois 61820 U.S.A.

DURATION OF EACH PHASE:

Mar./82	Planning	July-Sep./82	Laboratory Analysis
June/82	Field Study	Oct.-Dec./82	Data Analysis

APPROXIMATE COST: $7,000

OBJECTIVES: To evaluate the comparability of various methods in the determination of dry deposition. MOE uses the low-volume filtration method. Other techniques include Eddy Correlation, Variance, Eddy Accumulation, Gradients, Surrogate surface, bulk collection, wet and dry collection and leaf washing by 10 other groups.

METHOD: MOE method is described under Activity Title "Particulate and Gaseous Sulfur and Nitrogen Compound Sampling Network". Basically it involves ambient sampling at about 25 l.p.m. with filter packs to determine pollutant concentrations over 12-hour (0700-1900 and 1900-0700) intervals. These concentration data will be used together with appropriate deposition velocities to yield dry deposition information on particulate SO_4, NO_3, and NH_4, and gaseous SO_2 and HNO_3.

ANTICIPATED RESULTS: Information on the comparability of the various techniques for measuring dry deposition. A report of the overall results will be published by ISWS.

SUBJECT CODE: 2.3.2

PROJECT NUMBER: 88

TITLE: A Snowpack Chemistry Study of Small Lakes in Northern Saskatchewan

PRINCIPAL INVESTIGATOR'S NAME: Dr. S. R. Shewchuk

AGENCY AND DEPARTMENT: Saskatchewan Research Council, Physics Division

ADDRESS: 30 Campus Drive
Saskatoon, Saskatchewan
S7N 0X1

PHONE: (306) 664-5437

COOPERATING AGENCIES AND INVESTIGATORS: Saskatchewan Environment, Mr. L. Lechner

DURATION OF EACH PHASE: Two snowpack sampling surveys
- first survey - January 18 to 25, 1982
- second survey - March 22 to 25, 1982

APPROXIMATE COST: $18,500

OBJECTIVES: To study the deposition and accumulation of chemical species including sulphate, nitrate, hydrogen ions and various metals in the snowpack in Northern Saskatchewan.

METHOD:

1. Collect snow core samples from a distribution of 28 small lakes (about 2 km^2 in size) in Northern Saskatchewan.
2. Samples were transported to laboratory in the frozen state and kept frozen until time of chemical analysis.
3. Analyze samples for Cl^-, $SO_4^=$, NO_3^-, pH, HCO_3^-, $CO_3^=$, cond., and heavy metals.

ANTICIPATED RESULTS: To determine the chemical composition and accumulation of wet and dry deposited materials in Northern Saskatchewan.

NUMÉRO DE PROJET: 89

CODE DE SUJET: 2.3.3

TITRE: Dynamique du ^{137}Cs dans l'environnement terrestre et aquatique

NOM DU CHERCHEUR RESPONSABLE: Marcel Ouellet

MINISTÈRE, ORGANISME OU ORGANISME PRIVÉ, SERVICE: INRS-Eau

ADRESSE: Université du Québec
C.P. 7500
Sainte-Foy, Québec
G1V 4C7

TÉLÉPHONE: (418) 657-2555

COLLABORATEUR(S), ORGANISME(S) ET CHERCHEUR(S): H. G. Jones
même adresse

DURÉE DE CHAQUE PHASE:
a) échantillonnage: été 1980, 1981, 1982
b) analyse: 1982-83
c) compilation et rédaction: mars 1983

COÛT APPROXIMATIF: a) Etés 80, 81 et 82: $1,000 b) analyse: $2,000
c) compilation: $7,000

OBJECTIFS DE TRAVAIL: Préciser la dynamique du ^{137}Cs sur le bassin versant de lacs dans le but de prédire son comportement stratigraphique dans les sédiments lacustres.

MÉTHODE DE TRAVAIL: Améliorer la méthode chrono-stratigraphique de datation des sédiments lacustres au moyen des retombées nucléaires du ^{137}Cs.

RÉSULTATS PRÉVUS: Dynamique du ^{137}Cs largement fonction de la végétation et de la taille de chaque bassin versant.

SUBJECT CODE: 2.3.3

PROJECT NUMBER: 90

TITLE: The Acidity of Snow, Snowpack and Spring Run-Off

PRINCIPAL INVESTIGATOR'S NAME: O. Melo

AGENCY AND DEPARTMENT: Ontario Hydro Research Division

ADDRESS: 800 Kipling Avenue
Toronto, Ontario
M8Z 5S4

PHONE: (416) 231-4111

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: January 1983 - December 1984

APPROXIMATE COST:

OBJECTIVES: The acid spring run-off and associated pH depression of lake water is responsible for the best known detrimental effects of acid rain. Preliminary results indicate that:

a) N-acids account for a significant amount of the acidity of falling snow,

b) the relative amount of N-acids in snowpack is larger than in falling snow,

c) a few major storms account for the majority of the wet acidic deposition in winter and

d) most of the acidity stored in the snowpack is lost with the early melt water.

The objectives of the study will be to obtain a quantitative understanding of the factors that determine the acidity of snow, and spring run-off.

METHOD: Falling snow, snowpack and meltwater will be sampled, along with ambient concentrations of acidic pollutants to provide a better characterization of the snow system. Controlled experiments in which dry deposition is measured directly or estimated from ambient concentrations will also be performed to explain any differences between falling snow and snowpack. The time resolution of these measurements will be such that detailed analysis of the synoptic conditions associated with the major deposition events will be possible. This analysis will include transport, transformation and deposition modelling in which an attempt will be made to (a) explain why N-acids acquire such a predominant role relative to S-acids in snow and (b) identify the sources of emissions responsible for the acidity.

PROJECT NUMBER: 91

SUBJECT CODE: 2.3.3

TITLE: Snowpack Deposition Studies

PRINCIPAL INVESTIGATOR'S NAME: Dr. L. A. Barrie

AGENCY AND DEPARTMENT: Atmospheric Environment Service

ADDRESS: 4905 Dufferin Street
Downsview, Ontario
M3H 5T4

PHONE: (416) 667-4785

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: To March 1983.

APPROXIMATE COST: 25.0K

OBJECTIVES: To determine the deposition velocities of oxides of sulphur and nitrogen to a snowpack in acid sensitive areas of eastern Canada.

METHOD: At a forested location in the Canadian Shield (Chalk River, Ont.) the chemistry of the snowpack and of wet-only precipitation will be monitored within and outside of a forest canopy while simultaneously measuring atmospheric concentration of sulphur dioxide, nitric acid and particulate: sulphate, nitrate and trace elements.

ANTICIPATED RESULTS: A report on the total deposition rate of major ions and trace metals in the Canadian Shield and estimates of the ratio of dry to wet deposition.

SUBJECT CODE: 2.3.3

PROJECT NUMBER: 92

TITLE: Atmospheric Deposition Patterns of Sulphur and Trace Metals as measured by biomonitors.

PRINCIPAL INVESTIGATOR'S NAME: Dr. K. J. Puckett

AGENCY AND DEPARTMENT: Atmospheric Environment Service

ADDRESS: 4905 Dufferin Street
Downsview, Ontario
M3H 5T4

PHONE: (416) 667-4885

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: To March 1983.

APPROXIMATE COST: 13.0K

OBJECTIVES: To describe the deposition patterns of sulphur and lead in eastern Canada using lichens and mosses as biomonitors.

METHOD: Lichens unlike other plants do not have any roots and are thus dependent for their mineral nutrients on substances deposited as a result of wet and dry deposition to their plant surface. Lichens also can accumulate sulphur and other elements to levels far greater than their expected physiological needs and are perennial thus can be long-term integrators of deposition. A feasibility study was conducted recommending mapping of deposition patterns over larger areas of eastern Canada. The 127 km LRTAP parameter grid presently used for atmospheric modelling will be used as a basis for study.

ANTICIPATED RESULTS: Peat bog areas will be identified from topographic maps in each of the squares covering lower eastern Canada. Lichen samples will be collected and analyzed for sulphur, lead and mercury. A report will be completed of the analyses and deposition maps.

PROJECT NUMBER: 93

SUBJECT CODE: 2.3.3

TITLE: Study of Lake Sediments to Measure Fallout and Long-Distance Transport of Lead

PRINCIPAL INVESTIGATOR'S NAME: Dr. F. H. Rigler

AGENCY AND DEPARTMENT: McGill University, Biology Department

ADDRESS: 1205 Ave. Dr. Penfield Avenue
Montreal, Québec
H3A 1B1

PHONE: (514) 392-4675

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: July 1980 - March 1982

APPROXIMATE COST: 1st Year - $36,156 2nd Year - $31,662

OBJECTIVES:

1) To measure and compare the mean areal accumulation of anthropogenic lead in the Schefferville and Parc des Laurentides regions of Québec.
2) To develop and test a method of measuring the present rate of lead fallout.
3) To provide a simple method of measuring cumulative atmospheric fallout and long-range transport of lead.

METHOD:

1) Sediment cores were taken with a 7.0 cm diameter piston corer designed and built at McGill.
2) Cores were sectioned into 1.0 cm slices and frozen until analyzed. Deeper sections (>20 cm) were sectioned into 5 cm slices.
3) Partially thawed samples were weighed, dried and reweighed to yield wet mass and dry mass.
4) Sediments were ground to a fine powder. 0.5 grams of each section were digested with HNO_3 and HCl. The samples were then centrifuged and the supernatant was analyzed for its lead content on a Perkin-Elmer Model #403 Atomic Absorption Spectrophotometer.

ANTICIPATED RESULTS: Whole lake anthropogenic lead concentrations were calculated using Thiessen polygons. An average estimate of cumulative anthropogenic lead fallout for each region was also calculated. The average accumulated Pb fallout in the Schefferville region was 39 $mg.m^{-2}$ and in the Parc des Laurentides region was 333 $mg.m^{-2}$.

SUBJECT CODE: 2.3.3

PROJECT NUMBER: 94

TITLE: A Snowpack Chemistry Study of Small Lakes in Northern Saskatchewan

PRINCIPAL INVESTIGATOR'S NAME: Dr. S. R. Shewchuk

AGENCY AND DEPARTMENT: Saskatchewan Research Council, Physics Division

ADDRESS: 30 Campus Drive
Saskatoon, Saskatchewan
S7N 0X1

PHONE: (306) 664-5437

COOPERATING AGENCIES AND INVESTIGATORS: Saskatchewan Environment
Mr. L. Lechner

DURATION OF EACH PHASE: Two snowpack sampling surveys
- first survey - Jan. 18 to 25, 1982
- second survey -Mar. 22 to 25, 1982

APPROXIMATE COST: $18,500

OBJECTIVES: To study the deposition and accumulation of chemical species including sulphate, nitrate, hydrogen ions and various metals in the snowpack in Northern Saskatchewan.

METHOD:

1. Collect snow core samples from a distribution of 28 small lakes (about 2 km^2 in size) in Northern Saskatchewan.
2. Frozen samples were transported to laboratory for chemical analysis.
3. Analyze samples for Cl^-, $SO_4^=$, $NO_3^=$, pH, HCO_3^-, $CO_3^=$, conductivity and heavy metals.

ANTICIPATED RESULTS: To determine the chemical composition and accumulation of wet and dry deposited materials in Northern Saskatchewan.

PROJECT NUMBER: 95

SUBJECT CODE: 2.3.3

TITLE: Snowmelt Studies

PRINCIPAL INVESTIGATOR'S NAME: Dr. L. A. Barrie, E. Wilson

AGENCY AND DEPARTMENT: Atmospheric Environment Service

ADDRESS: 4905 Dufferin Street
Downsview, Ontario
M3H 5T4

PHONE: (416) 667-4785

COOPERATING AGENCIES AND INVESTIGATORS: T. Agnew, AES

DURATION OF EACH PHASE: To October 1982 - 1st report.
Further model development 1983/84.

APPROXIMATE COST: 2.0K 82/83

OBJECTIVES: To analyze frequency and concentration of acidic snowmelt in areas of eastern Canada based on climatological data and total deposition measurements and to identify regions of high acidic impact.

METHOD: In sections of eastern Canada, a large portion of the yearly precipitation falls as snow and an extensive snow cover is present throughout the winter months. Acidic pollutants are carried into this area and scavenged by wet and dry deposition processes, and then are stored in the snowpack where they accumulate until released in meltwater during mid-winter or spring thaws. The very first fractions melted can produce a harmful pulse of acidic water. The precipitation data for stations in the above mentioned regions are analyzed using a hydrometeorological model of the water budget of a snowpack modified to incorporate pollutants.

ANTICIPATED RESULTS: A report on the climatology of acidic snowmelt shock potential in eastern Canada is completed. Reports detailing the development of the model, the outputs and program listing are available. Data tapes of snowmelt parameters and pollution potential indices are available.

CODE DU SUJET: 2.3.3

NUMÉRO DE PROJET: 96

TITRE: Choc Printannier

NOM DU CHERCHEUR RESPONSABLE: à déterminer

MINISTÈRE, ORGANISME OU ORGANISME PRIVÉ, SERVICE: Service de l'environnement atmosphérique
Région du Québec

ADRESSE: 100, boul. Alexis Nihon
Ville St-Laurent, Québec
H4M 2N6

TÉLÉPHONE: (514) 333-3020

COLLABORATEUR(S), ORGANISME(S) ET CHERCHEUR(S):

DURÉE DE CHAQUE PHASE:

COÛT APPROXIMATIF: $1K

OBJECTIFS DE TRAVAIL: Donner des indications qui puissent permettre de quantifier l'importance du choc printannier.

MÉTHODE DE TRAVAIL: Produire une analyse de l'évolution des quantités de neige au sol sur le Québec au printemps pour la période s'étendant de 1965-1982. Cette analyse sera basée sur les données climatologiques existantes. En reliant cette analyse aux données recueillies depuis 1977 aux stations CANSAP, l'on pourra produire en estimé du choc printannier en terme de sulfate et nitrate libérés.

RÉSULTATS PRÉVUS: Les résultats de l'étude pourront servir à analyser les différentes statistiques sur le comportement de la faune aquatique.

NUMÉRO DE PROJET: 97

CODE DE SUJET: 2.3.3

TITRE: Evaluation des dépôts secs l'hiver

NOM DU CHERCHEUR RESPONSABLE: à déterminer

MINISTÈRE, ORGANISME OU ORGANISME PRIVÉ, SERVICE: Service de l'environnement atmosphérique
Région du Québec

ADRESSE: 100, boul. Alexis Nihon
Ville St-Laurent, Québec
H4M 2N8

TÉLÉPHONE: (514) 333-3020

COLLABORATEUR(S), ORGANISME(S) ET CHERCHEUR(S):

DURÉE DE CHAQUE PHASE:

COÛT APPROXIMATIF:

OBJECTIFS DE TRAVAIL: Evaluer l'importance du processus de déposition sèche comparativement au processus humide en termes du pH et des concentrations en nitrates et sulfates de la neige et en étudier à variation spatiale sur le Québec.

MÉTHODE DE TRAVAIL: Le projet consisterait, dans un premier temps, à établir un réseau de 5 à 6 stations de collecte des précipitations et d'échantillonnage de la neige au sol.

Ces échantillons seront, dans un deuxième temps, analysés en terme de pH et contenu en sulfate et nitrate. Il sera ainsi possible de déduire certaines informations sur l'importance des dépôts secs au Québec l'hiver.

RÉSULTATS PRÉVUS: Des indications sur l'importance du mécanisme de déposition sec et sa variabilité sur les diverses parties du Québec.

CODE DU SUJET: 2.4.1

NUMÉRO DE PROJET: 98

TITRE: Évaluation du taux de dépôts acides

NOM DU CHERCHEUR RESPONSABLE: Lévis Talbot

MINISTÈRE, ORGANISME OU ORGANISME PRIVÉ, SERVICE: Service de la qualité des eaux
Ministère de l'Environnement du Québec (MENVIQ)

ADRESSE: 2360, chemin Ste-Foy
Ste-Foy, Québec
G1V 4H2

TÉLÉPHONE: (418) 643-4425

COLLABORATEUR(S), ORGANISME(S) ET CHERCHEUR(S): Service de la météorologie, MENVIQ
Laboratoires de Québec, MENVIQ

DURÉE DE CHAQUE PHASE:

COÛT APPROXIMATIF:

Activité 1 - mars 1980 à septembre 1980:		$6,000	(MENVIQ)
Activité 2 - juin 1981 à juin 1982:	Achat	$75,000	"
	Installation	$35,000	"
Activité 3 - depuis juin 1981:		$50,000/année	"
Activité 4 - depuis juin 1981:		$20,000/achats	"
		$15,000/année	"
Activité 5 - sept. 1982 à sept. 1983:		$30,000	"
à partir de sept. 1983:		$10,000/année	"

OBJECTIFS DE TRAVAIL: Évaluer les taux de dépôts acides au Québec en mettant l'accent sur les régions sources et les zones sensibles à l'acidification.

MÉTHODE DE TRAVAIL:

Activité 1 - Conception.

Activité 2 - Achat et installation des collecteurs automatiques à 45 stations météorologiques situées au sud de 56^{e} parallèle.

Activité 3 - Opération des stations sur une base hebdomadaire.

Activité 4 - Analyse des ions majeurs et des paramètres physico-chimiques reliés à l'acidification des précipitations.

Activité 5 - Traitement et interprétation des résultats.

RÉSULTATS PRÉVUS:

PROJECT NUMBER: 99

SUBJECT CODE: 2.4.1

TITLE: CANSOC: Organics in Precipitation

PRINCIPAL INVESTIGATOR'S NAME: G. L. Brun

AGENCY AND DEPARTMENT: Water Quality Branch, IWD, Environment Canada

ADDRESS: P.O. Box 861
Moncton, N.B.
E1C 8N6

PHONE: (506) 388-6606

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: Ongoing

APPROXIMATE COST: $6,000/annum

OBJECTIVES: Part of the national goal in identifying and quantifying selected organic pollutants carried through long range transport.

METHOD: Two modified Sangamo precipitation samplers have been in operation since August 1980, one in Nova Scotia, the other in P.E.I. The precipitation samples are collected monthly and analyzed for organochlorines, polychlorinated biphenyls, chlorobenzenes and polyaromatic hydrocarbons.

ANTICIPATED RESULTS: Data interpretive reports are prepared periodically. All data are also placed in NAQUADAT.

SUBJECT CODE: 2.4.1

PROJECT NUMBER: 100

TITLE: Chemistry of Summer Precipitation in the Oil Sands Area

PRINCIPAL INVESTIGATOR'S NAME: Ms. B. Magill

AGENCY AND DEPARTMENT: Research Management Division, Alberta Environment

ADDRESS: 14th Floor, Standard Life Centre
10405 Jasper Avenue
Edmonton, Alberta
T5J 3N4

PHONE: (403) 427-3943

COOPERATING AGENCIES AND INVESTIGATORS: This work was contracted out to Stanley Associates Engineering Ltd., Mayfield Business Centre, 10512 - 169 Street, Edmonton, Alberta T5P 3X6, for the 1982 summer field study.

DURATION OF EACH PHASE: Commenced in 1976 - ongoing.

APPROXIMATE COST: $9,000 (82-83)

OBJECTIVES: This project is designed to collect rainfall, on an event basis, in the AOSERP study area, to investigate the amount and distribution of pollutants in the air. Objectives of the study are (i) to determine changes in the input rate of atmospheric trace substances into sensitive ecosystems, (ii) to provide a data base for the identification of trends in the chemical characteristics of the precipitation, and (iii) to monitor the level of background pollutants.

METHOD: Contact the principal investigator for project methodology.

ANTICIPATED RESULTS: Initial data can be obtained from the Research Management Division, Alberta Environment.

PROJECT NUMBER: 101

SUBJECT CODE: 2.4.1

TITLE: Baseline Event - Precipitation Sampling in Eastern Manitoba

PRINCIPAL INVESTIGATOR'S NAME: Dave Bezak

AGENCY AND DEPARTMENT: Manitoba Department of Consumer and Corporate Affairs and Environment, Environmental Management Division

ADDRESS: P.O. Box 7, Building 2
139 Tuxedo Avenue
Winnipeg, Manitoba
R3C 0V8

PHONE: (204) 895-5273

COOPERATING AGENCIES AND INVESTIGATORS: Atmospheric Environment Service
Hugh Fraser

DURATION OF EACH PHASE: Continuing

APPROXIMATE COST: $45,000 Capital $40,000 Operation for 1982-83 fiscal year.

OBJECTIVES:

a) To monitor levels for various chemical constituents/indicators in the remote Canadian Shield area of Eastern Manitoba.

b) To use this data in conjunction with other activities to determine whether acid precipitation is occurring.

METHOD:

a) Sangamo Type A Precipitation collectors will be set up at existing AES weather sites at Norway House and Island Lake.

b) Samples will be collected in a manner similar to the CANSAP operations.

c) Analyses will be performed for sulphates, nitrogen compounds, Chloride, metal ions (Na, K, Ca, Mg, As, Cu, Pb, Zn, Fe), acidity, alkalinity, pH, electrical conductance.

ANTICIPATED RESULTS:

a) Data will be used to determine the need for continued monitoring.

b) Data levels will be used along with other studies to identify and quantify the extent of acid precipitation.

SUBJECT CODE: 2.4.1

PROJECT NUMBER: 102

TITLE: Precipitation Monitoring - APN

PRINCIPAL INVESTIGATOR'S NAME: Dr. Gilles Robitaille
Doe, CFS

AGENCY AND DEPARTMENT: Laurentian Forest Research Centre

ADDRESS: P.O. Box 3800
Ste-Foy, Québec
G1V 4C7

PHONE: (418) 658-6945

COOPERATING AGENCIES AND INVESTIGATORS: Dr. Len Barrie, AES, Downsview

DURATION OF EACH PHASE: December 1980 to end of LRTAP project.

APPROXIMATE COST: 1980-81: 5K 1981-82: 5K 1982-83: 8K 1983-84: 10K

OBJECTIVES: To operate, collect and ship precipitation samples (both wet and dry) as a station within the APN network.

METHOD: Standard methods given by AES, Downsview. The following equipment are operative: a Sangamo type collector for snow and rain, a filter system for particulates. As of May 1983 two high volume samplers will be functional for the determination of organics and inorganics (are presently installed) (pH, sulphate, nitrate, chloride, calcium, sodium, ammonium, magnesium, potassium and total phosporus are measured in the precipitation. In addition SO_2 is analysed on the filters).

ANTICIPATED RESULTS: Data on the input of the major ions to the lac Laflamme watershed and data for the nationwide APN network.

Reported on by AES, Downsview.

PROJECT NUMBER: 103

SUBJECT CODE: 2.4.1

TITLE: Ontario Hydro Air, Aerosol and Precipitation Chemistry Monitoring Network

PRINCIPAL INVESTIGATOR'S NAME: T. Jarv

AGENCY AND DEPARTMENT: Ontario Hydro Research Division

ADDRESS: 800 Kipling Avenue
Toronto, Ontario
M8Z 5S4

PHONE: (416) 231-4111
Ext. 7001

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: Several phases from 1975 to June, 1983.

APPROXIMATE COST: Approximately $120,000, (1982 $) per year

OBJECTIVES: (a) To study the composition of air, aerosol and precipitation in terms of spatial and temporal fluctuations in the airshed over Ontario: (b) to determine, by means of the survey, whether emissions from our plants lead to identifiable contributions to precipitation acidity and sulfate and nitrate aerosol concentrations at sensitive receptor areas; (c) to provide input data for the validation of atmospheric long range transport models and (d) to provide a focus for laboratory and field studies concerning atmospheric transformation and removal processes.

METHOD: (a) Precipitation samples are collected on a daily basis from about 0800 EST to 0800 EST of the next day from Monday to Friday and a single composite sample for the weekend with wet-only Sangamo Type-A samplers. Analysis for pH, sulfate, nitrate, ammonium, chloride, calcium, magnesium, sodium and potassium ions is carried out by Analytic Services of Ontario Hydro Research; (b) Modified Sierra dichotomous samplers using filter packs on the coarse and fine air streams to sample for particulate sulfate, nitrate and ammonia on the teflon filters and SO_2 from impregnated Whatman 41 filters; (c) comparisons with APN and APIOS networks have been made.

ANTICIPATED RESULTS:

1. Established facts concerning the physical and chemical nature of air, aerosol and precipitation in Ontario.
2. High quality data base to define conditions for further detailed study and to test long range transport models.

SUBJECT CODE: 2.4.1

PROJECT NUMBER: 104

TITLE: Performance Audits of the APIOS Wet-only Event Network

PRINCIPAL INVESTIGATOR'S NAME: Dr. Walter Chan

AGENCY AND DEPARTMENT: Ontario Ministry of the Environment, Air Resources Branch

ADDRESS: 880 Bay Street, 4th Floor
Toronto, Ontario
M5S 1Z9

PHONE: (416) 965-1634

COOPERATING AGENCIES AND INVESTIGATORS:

Contractor:
Dr. William James
Dept. of Civil Engineering
McMaster University
Hamilton, Ontario

DURATION OF EACH PHASE: Overall program 8-11/82

APPROXIMATE COST: $13,500 (8/82-11/82)

OBJECTIVES: To develop, construct, test and install instrumentation (sensor and data logger) at 5 APIOS event sites to record precipitation intensity and Aerochem Metrics sampler performance.

METHOD:

a) To develop an electronic device which is capable of recording rainfall intensity and the opening/closing of the precipitation sampler load upon precipitation activation of the sensor accurate to the nearest minute.

b) The collected data will be computer decoded.

ANTICIPATED RESULTS: A report describing the equipment, decoding software and the performance of the Aerochem Metrics sampler will be prepared by the contractor.

PROJECT NUMBER: 105

SUBJECT CODE: 2.4.1

TITLE: Cumulative Wet and Dry Deposition Network

PRINCIPAL INVESTIGATOR'S NAME: Dr. Walter Chan

AGENCY AND DEPARTMENT: Ontario Ministry of the Environment, Air Resources Branch

ADDRESS: 880 Bay Street, 4th Floor
Toronto, Ontario
M5S 1Z8

PHONE: (416) 965-1634

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: Operation 9/80 to at least 3/86

APPROXIMATE COST: $99,000 (4/82-3/83)

OBJECTIVES: To establish the long term wet and dry deposition distribution patterns of acid, acid forming materials and trace metals across the Province of Ontario.

METHOD:

a) MOE-modified Sangamo type A, wet and dry samplers are used in 36 background sites across Ontario.
b) Polyethylene bags custom-made to fit the Sangamo bucket are used to collect precipitation and dryfall samples separately over 4-week periods. Collection is made on Tuesday morning.
c) In winter snow sampling, the container is modified to give a 4:1 height to diameter ratio to improve sampling efficiency.
d) Storage gauges are used to measure precipitation depth.
e) Samples are sent to the Toronto-MOE-LSB laboratory in polyethylene bags for chemical analysis (volume, conductivity, pH, total acidity, SO_4, NO_3, Cl, NH_4, Ca, Na, K, TKN, TP, Mg, Zn, Fe, Ni, Cu, Pb, Al, Cd, Mn and V).

ANTICIPATED RESULTS:

a) Data are entered into the MOE database, and after editing will be transferred to NAQUADAT in Ottawa, SAROAD in RTP (US EPA) and MAP 3S (BNL) databases.

b) Ministry reports are issued to the public after internal review.

SUBJECT CODE: 2.4.1

PROJECT NUMBER: 106

TITLE: Quality Assurance of APIOS Networks

PRINCIPAL INVESTIGATOR'S NAME: Dr. Walter Chan

AGENCY AND DEPARTMENT: Ontario Ministry of the Environment, Air Resources Branch

ADDRESS: 880 Bay Street, 4th Floor
Toronto, Ontario
M5S 1Z8

PHONE: (416) 965-1634

COOPERATING AGENCIES AND INVESTIGATORS:
Contractor:
Mr. S. Onlock
Concord Scientific Corporation
2 Tippett Road
Downsview, Ontario

DURATION OF EACH PHASE: Overall program 2-11/82

APPROXIMATE COST: $40,000 (2/82-11/82)

OBJECTIVES: To perform performance and systems audits of the Acidic Precipitation in Ontario Study wet and dry deposition monitoring networks.

METHOD:

a) A general review of the APIOS networks and an assessment of the Quality Assurance Plan.

b) Systems and performance audits of the APIOS networks including the following components:
- network representativeness
- site operators/technicians
- sample storage and shipping
- sampler operation and maintenance
- sample analysis
- data handling, validation and reporting

ANTICIPATED RESULTS: An auditor's report will be issued appraising the quality of the APIOS networks.

PROJECT NUMBER: 107

SUBJECT CODE: 2.4.1

TITLE: Ontario-Quebec Precipitation Sampling Intercomparison

PRINCIPAL INVESTIGATOR'S NAME: Dr. Walter Chan

AGENCY AND DEPARTMENT: Ontario Ministry of the Environment, Air Resources Branch

ADDRESS: 880 Bay Street, 4th Floor
Toronto, Ontario
M5S 1Z8

PHONE: (416) 965-1634

COOPERATING AGENCIES AND INVESTIGATORS: Mr. Michel Ferland
Environment Quebec
2360 Chemin Sainte-Foy
Quebec City, Quebec
G1V 4H2

DURATION OF EACH PHASE: Tentatively Nov./82 - Oct./83

APPROXIMATE COST: $2,000

OBJECTIVES: To intercompare precipitation networks operated by the Ontario and Quebec governments - their overall compatibility including instrumentation, sample handling and chemical analysis.

METHOD:

a) Each network will set up its regular instrumentation at St. Joachim des Rapides and handle the sampling according to their regular procedures, Quebec operates on a 7-day cycle whereas Ontario operates the cumulative network on a 28 day cycle.

b) Samples will be sent to respective laboratories for analysis.

c) Final results will be compiled and compared - Quebec data will be synthesized to give 28-day equivalents.

ANTICIPATED RESULTS: A joint report will be published regarding data comparability.

SUBJECT CODE: 2.4.1

PROJECT NUMBER: 108

TITLE: Precipitation Acidity in Northwestern British Columbia

PRINCIPAL INVESTIGATOR'S NAME: M. S. Kotturi

AGENCY AND DEPARTMENT: Ministry of Environment/Air Studies Branch

ADDRESS: Air Studies Branch
Ministry of Environment
Parliament Buildings
Victoria, B.C.
V8V 1X5

PHONE: (604) 387-5888

COOPERATING AGENCIES AND INVESTIGATORS: Atmospheric Environment Service/
S. Nikleva

DURATION OF EACH PHASE: 09/1980 to 04/1983

APPROXIMATE COST: current fiscal year $10,000

OBJECTIVES:

a) Individual storms are being sampled and related storm track information retrieved for subsequent data analysis.

b) Precipitation samples being taken by co-locating provincial site with CANSAP site to investigate reasons for depressed pH values recorded at the CANSAP site.

METHOD:

i) Precipitation samples are collected on event basis using manual collector, using a funnel and bottle collector system. Analysis of Al, Ca, Mg, Na, K, NH_4, NO_3, PO_4, SO_4, F, Cl, total acidity and strong acidity and pH are carried out by the Environmental Laboratory.

ii) The comparison of storm trajectories with observed ionic loadings offer insight into contribution of ionic inputs from local and distant sources.

ANTICIPATED RESULTS: Results may illustrate impact of local industries (e.g. Kitimat) on precipitation acidity.

Consideration is being given to expand the network to interior British Columbia.

PROJECT NUMBER: 109

SUBJECT CODE: 2.4.1

TITLE: Event Wet Deposition Network

PRINCIPAL INVESTIGATOR'S NAME: Dr. Walter Chan

AGENCY AND DEPARTMENT: Ontario Ministry of the Environment, Air Resources Branch

ADDRESS: 880 Bay Street, 4th Floor
Toronto, Ontario
M5S 1Z8

PHONE: (416) 965-1634

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: Operation 7/80 (partial operation only) to at least 3/86

APPROXIMATE COST: $63,000 (4/82-3/83)

OBJECTIVES:

a) To study the chemical composition, frequency and intensity of acidic precipitation episodes in the Province.

b) To determine in combination with trajectory analysis the acidic loading associated with air masses from different sectors.

METHOD:

a) At 4 sites (Dorset, London, Kingston & Atikoken areas) co-located with airborne particulate sampling trains. At each area, there are 5 samplers. The distance between two pairs of samplers is about 50-100 km and that between the two samplers within a pair is on the order of 10 km. The fifth sampler is co-located a few meters apart from one of the four others.

b) Precipitation sampling is carried out over a 24 hr period (0800-0800) using Aerochem Metrics wet-only samplers with polyethylene bags inserted into the samplers.

c) Samples will be transferred to Toronto MOE-LSB laboratory for chemical analysis (volume, conductivity, pH, total acidity, SO_4, NO_3, Cl, NH_4, Ca, Na, K, Mg).

d) At some sites, Fisher Porter and Tipping bucket rain gauges and Nipher - shielded gauges, will be also in operation.

ANTICIPATED RESULTS:

a) Data are entered into the MOE database, and after editing will be transferred to NAQUADAT, SAROAD and MAP3S databases.

b) Ministry reports are issued to the public after internal review.

SUBJECT CODE: 2.4.1

PROJECT NUMBER: 110

TITLE: Monitoring pH in Quebec

PRINCIPAL INVESTIGATOR'S NAME: R. Gilbert

AGENCY AND DEPARTMENT: Atmospheric Environment Service, Environment Canada

ADDRESS: Quebec Regional Offices
Montreal, Quebec

PHONE: (514) 835-9328

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: April 1982 - March 1983

APPROXIMATE COST: 14.6K 82/83

OBJECTIVES: To monitor pH in Quebec on a smaller temporal and spatial scale.

METHOD: At existing CANSAP, APN and Environment Quebec network stations, intensive sampling analysis took place between August 16 to September 30, 1982. One measurement was made per day at each of the 42 stations. Four have 2 samplers. Area of coverage is 12,500 km^2 giving an average distance of 55 km between stations. A sample of known pH will be sent to each station and exposed for a 24 hour period without rain sent back to the lab for a comparison analysis. Samples will be collected, stored and forwarded to the Downsview lab for sulphate analysis.

ANTICIPATED RESULTS: A report will outline results of the intensive areal study.

PROJECT NUMBER: 111

SUBJECT CODE: 2.4.1

TITLE: Canadian Network for Sampling Precipitation (CANSAP)

PRINCIPAL INVESTIGATOR'S NAME: M. Still

AGENCY AND DEPARTMENT: Atmospheric Environment Service, Environment Canada

ADDRESS: 4905 Dufferin Street
Downsview, Ontario
M3H 5T4

PHONE: (416) 667-4988

COOPERATING AGENCIES AND INVESTIGATORS: Dr. J. Young, Dr. L. Barrie
Atmospheric Environment Service

DURATION OF EACH PHASE: Ongoing

APPROXIMATE COST: 54.8K 82/83

OBJECTIVES: To collect, archive and publish data on the status and trends of precipitation quality.

METHOD: 54 CANSAP sampling stations in a network across Canada collect monthly samples of rain or snow. Each sample is analyzed for acidity and soluble major ions including sulphate and nitrate. 1977-81 data has been prepared for publication.

ANTICIPATED RESULTS: Provision of monthly sampling analyses at stations in the Canadian network in a regular semi-annual report publication (CANSAP Data Summary). Provision of a database for operation and research use.

SUBJECT CODE: 2.4.1

PROJECT NUMBER: 112

TITLE: Wet Deposition Monitoring Network in Newfoundland

PRINCIPAL INVESTIGATOR'S NAME: Dr. Les Hulett

AGENCY AND DEPARTMENT: Dept. of Environment

ADDRESS: Govt. of Nfld. and Labrador
P.O. Box 4750
St. Johns, Nfld.
A1C 5T7

PHONE: (709) 737-2554

COOPERATING AGENCIES AND INVESTIGATORS: Canadian Forestry Service - J. G. Zakrevsky
Environmental Protection Service - B. Power
Dept. of Fisheries and Oceans - W. Bruce

DURATION OF EACH PHASE: Operation: Sept. 1980 for indefinite period.

APPROXIMATE COST: For 1982/83 $10,000

OBJECTIVES: To establish of a wet deposition monitoring network, and to collect precipitation samples on a weekly basis, in Newfoundland. The samples are to be analyzed for the same parameters as CANSAP.

METHOD: At present five wet deposition only samples are being operated at sites across Newfoundland. Wet desposition is collected weekly and sent to St. John's for analysis. The following parameters are being determined: pH, conductivity, Na^+, K^+, NH_4^+, Mg^{++}, Ca^{++}, Cl^-, NO_3^-, SO_4^{2-}. One sampler has been co-located with the APN Station at Bay d'Espoir to permit inter network comparison.

ANTICIPATED RESULTS: Acidic deposition levels are being assessed across the province and this information is being coordinated with soil sensitivity and surface water sensitivity to determine regions of high potential impact.

PROJECT NUMBER: 113

SUBJECT CODE: 2.4.1

TITLE: Environment New Brunswick Precipitation Monitoring Network

PRINCIPAL INVESTIGATOR'S NAME: Jane Spavold

AGENCY AND DEPARTMENT: Environmental Services Branch, Environment New Brunswick

ADDRESS: P.O. Box 6000
Fredericton, New Brunswick
E3B 5H1

PHONE: (506) 453-2669

COOPERATING AGENCIES AND INVESTIGATORS: Canadian Forestry Service, Fredericton

DURATION OF EACH PHASE: Operation until at least 1983

APPROXIMATE COST: 1982 $20,000

OBJECTIVES:

- to monitor the quality of precipitation at locations in N.B. remote from local pollutant sources;
- to assess spatial and temporal variation in deposition and concentration of pollutants in precipitation.

METHOD:

- 4 stations (Grand Manan, Nictau, Fredericton, Harcourt)
- monthly composite collections of wet precipitation using Sangamo Type A Collectors fitted with polyethylene inserts
- analysis for pH, acidity, conductivity, $SO_4^{=}$, NO_x, Cl^-, NH_3, Na^+, K^+, Mg^{++}, Ca^{++},
- event sampling and analysis for trace metals done on a trial basis in 1982.

ANTICIPATED RESULTS: Yearly data summaries available, subject to internal review. Preliminary report available second quarter, 1982.

SUBJECT CODE: 2.4.1

PROJECT NUMBER: 114

TITLE: Precipitation Monitoring Network, Northern Saskatchewan

PRINCIPAL INVESTIGATOR'S NAME: Mr. L. Lechner

AGENCY AND DEPARTMENT: Saskatchewan Environment

ADDRESS: 1855 Victoria Avenue, 5th Floor
Regina, Saskatchewan
S4N 3V5

PHONE: (306) 565-6195

COOPERATING AGENCIES AND INVESTIGATORS: Saskatchewan Research Council
Analytical Laboratory
30 Campus Drive
Saskatoon, Saskatchewan
S7N 0X1

DURATION OF EACH PHASE: July 1 to October 31, 1982

APPROXIMATE COST: $15,000

OBJECTIVES: To monitor wet deposition on an event basis at 5 stations in Northern Saskatchewan.

METHOD:

a) Collection of wet samples using a manual collector.

b) Samples to be collected on an event basis.

c) Sampling locations:
- Stoney Rapids
- La Loche
- Pelican Narrows
- Dreaver Lake
- Kane Lake

ANTICIPATED RESULTS: To determine the chemical composition of wet deposited materials in Northern Saskatchewan.

PROJECT NUMBER: 115

SUBJECT CODE: 2.4.1

TITLE: Precipitation Chemistry in Nova Scotia

PRINCIPAL INVESTIGATOR'S NAME: Mr. J. K. Underwood

AGENCY AND DEPARTMENT: Nova Scotia Department of the Environment

ADDRESS: P.O. Box 2107
Halifax, N.S.
B3J 3B7

PHONE: (902) 424-5300

COOPERATING AGENCIES AND INVESTIGATORS: Parks Canada, Department of Fisheries & Oceans, Nova Scotia Department of Education (Operate rain samplers). Analyses conducted by Dr. R. McCurdy, Nova Scotia Department of Health.

DURATION OF EACH PHASE: Study initiated in 1977 - at present 5 weekly stations.

APPROXIMATE COST: Analytical costs $15,000/year

OBJECTIVES: Determine annual wet and dry deposition of major ions, acids, nutrients and metals in Nova Scotia.

METHOD: Five Sangamo type wet/dry collectors spread across province operated on weekly basis. Analysed for 29 parameters.

ANTICIPATED RESULTS: While major interpretive report is in preparation, 3 preliminary reports are available:

Underwood 1979: pH of Precipitation and annual deposition of S, H and N on N.S.

Underwood 1981: Acidic Precipitation in Nova Scotia.

Underwood 1981: Monitoring Acid Rain

Acid loading between 1/3 & 1/2 that in Ontario, the Adirondacks & Norway.

SUBJECT CODE: 2.4.1

PROJECT NUMBER: 116

TITLE: Dustfall

PRINCIPAL INVESTIGATOR'S NAME: W. W. Fraser, Director Safety and Environment

AGENCY AND DEPARTMENT: Hudson Bay Mining and Smelting, Environmental Control

ADDRESS: P.O. Box 1500
Flin Flon, Manitoba

PHONE: (204) 687-5221

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: Ongoing

APPROXIMATE COST: $8,000/year

OBJECTIVES: To determine particulate fallout in vicinity of Flin Flon metallurgical operations.

METHOD: ASTM D1739 Dustfall

2 sample sites located 0.3 and 1.0 miles from stack analyzed for suspended solids, dissolved solids, ignition loss.

ANTICIPATED RESULTS:

PROJECT NUMBER: 117

SUBJECT CODE: 2.4.1

TITLE: Sulfation Rates

PRINCIPAL INVESTIGATOR'S NAME: W. W. Fraser, Director Safety and Environment

AGENCY AND DEPARTMENT: Hudson Bay Mining and Smelting Co., Ltd., Environmental Control Dept.

ADDRESS: P.O. Box 1500
Flin Flon, Manitoba

PHONE: (204) 687-5221

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: Ongoing

APPROXIMATE COST: $8,500/year

OBJECTIVES: To provide average sulfation levels over a two month period for a number of locations within a 45 mile radius of Flin Flon.

METHOD: ASTM D2010

Total sulfation using lead peroxide candles. Candles collected every two months from 22 sample locations ranging from 1-45 miles from stack.

ANTICIPATED RESULTS:

SUBJECT CODE: 2.4.1

PROJECT NUMBER: 118

TITLE: Hi Vol Sampling Program

PRINCIPAL INVESTIGATOR'S NAME: W. W. Fraser, Director Safety and Environment

AGENCY AND DEPARTMENT: Hudson Bay Mining and Smelting Co., Environment Department

ADDRESS: P.O. Box 1500
Flin Flon, Manitoba

PHONE: (204) 687-5221

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE:

APPROXIMATE COST: $8,000/year

OBJECTIVES:
- measurement of airborne particulate levels
- determination of various metal concentrations

METHOD:
- collect samples at 2 locations 0.5 and 3 miles from stack
- high volume sampler with glass fibre filters
- filters collected on a weekly basis
- analyzed by AA for copper, zinc, arsenic, lead and cadmium

ANTICIPATED RESULTS:

PROJECT NUMBER: 119

SUBJECT CODE: 2.4.1

TITLE: Atikokan Air Quality and Meteorological Monitoring Program

PRINCIPAL INVESTIGATOR'S NAME: A. Hoffer

AGENCY AND DEPARTMENT: Environmental Studies & Assessments Dept.

ADDRESS: Design & Development Division
Ontario Hydro
700 University Avenue
Toronto, Ontario
M5G 1X6

PHONE: (416) 592-6308

COOPERATING AGENCIES AND INVESTIGATORS:
Dr. H. D. Griffin
Chief, Air Quality Assessment
Ontario Ministry of the Environment - NW Region
P.O. Box 5000, Thunder Bay, Ontario P7C 5G6
(807) 475-1215

DURATION OF EACH PHASE: 3-Year Preoperation Monitoring
(Prior to startup of Atikokan Generating Station)

APPROXIMATE COST: $4,500/Year

OBJECTIVES:

- To determine preoperational wet deposition characteristics prior to operation of 200-MW Lignite-fired thermal generating station at Atikokan, Ont.

- To determine effects of station operation on wet deposition chemistry and verify predicted effects, in sensitive receptor areas.

METHOD: Sangamo - monthly cumulative wet deposition sampler.

Analyses for: SO_4^{2-}, NO_3^-, NH_4^+, Ca^{2+}, Mg^{2+}, Na^{2+}, K^+, Cl^-, pH, acidity, conductivity, volume.
Trace elements (to be done on a limited basis in the future) Zn, Fe, Ni, Cu, Pb, Al, Cd, Mn.

Methods:
1 - Ion chromatography
2 - Automated phenol-hypochlorite method
3 - Flame atomic absorption
4 - Radiometer
5 - NaOH titration to pH 8.3

ANTICIPATED RESULTS:
SO_4^{2-} = 0.120 ug/cm^2/d
NO_3^- = 0.09 ug/cm^2/d

CODE DU SUJET: 2.4.1

NUMÉRO DE PROJET: 120

TITRE: Projet pH

NOM DU CHERCHEUR RESPONSABLE: Richard Gilbert

MINISTÈRE, ORGANISME OU ORGANISME PRIVÉ, SERVICE: Service de l'environnement atmosphérique, Région du Québec

ADRESSE: 100, Boul. Alexis Nihon
3ième étage
Ville St-Laurent, Québec
H4M 2N8

TÉLÉPHONE: (514) 333-3020

COLLABORATEUR(S), ORGANISME(S) ET CHERCHEUR(S): SEA: Direction de la recherche en qualité de l'air
SEA: Région du Québec

DURÉE DE CHAQUE PHASE:
- Mise sur pied du réseau (Mai-Aout/82)
- Collecte des échantillons (15-08 au 30-09/82)
- Analyse des échantillons (Sept-Nov/82)
- Analyse des systèmes météo et des rétro-trajectoires (Nov-Déc/82)
- Rédaction du rapport (Jan 1983)

COÛT APPROXIMATIF: Mai 82 à Jan. 83 Capital, Opération et Entretien: $14,600
Salaire: $38,600

OBJECTIFS DE TRAVAIL:
- Déterminer les variations spatio-temporelles du pH et de la concentration des sulfates dans les précipitations au Québec.
- Etudier la représentativité de trois stations du réseau CANSAP et de la station du réseau APN du sud du Québec.

MÉTHODE DE TRAVAIL:
- Mise sur pied sur le sud du Québec, d'un réseau temporaire de 42 stations distancées d'environ 50 kilomètres.
- Collecte d'échantillons d'eau de pluie à tous les jours du 16 août au 30 septembre 1982.
- Analyse du pH des échantillons et de la concentration de sulfates.

RÉSULTATS PRÉVUS:
- Champ du pH et de la concentration de SO_4 pour environ 25 évènements.
- Analyse des systèmes météorologiques et des rétro-trajectoires correspondant à chaque évènement.

NUMÉRO DE PROJET: 121

CODE DU SUJET: 2.4.1

TITRE: Réseau pH-II

NOM DU CHERCHEUR RESPONSABLE:

MINISTÈRE, ORGANISME OU ORGANISME PRIVÉ, SERVICE: Service de l'environnement atmosphérique, Région du Québec

ADRESSE: 100, boul. Alexis Nihon
Ville St-Laurent, Québec
H4M 2N8

TÉLÉPHONE: (514) 333-3020

COLLABORATEUR(S), ORGANISME(S) ET CHERCHEUR(S):

DURÉE DE CHAQUE PHASE:

COÛT APPROXIMATIF: $15K

OBJECTIFS DE TRAVAIL: Etablissement d'un réseau temporaire de 5 à 6 stations sur le nord et le centre du Québec qui puisse permettre de caractériser la distribution spatiale et temporelle de l'acidité des précipitations et de leurs contenus en nitrates et sulfates sur cette portion du Québec.

MÉTHODE DE TRAVAIL: Ce réseau sera composé de 5 à 6 stations où seront recueillis durant une année des échantillons quotidiens de précipitation. Pour les besoins de la cause, l'on aura à développer un collecteur de précipitation, des procédures d'opérations et de contrôle de qualité et des critères de localisation des sites. L'analyse des échantillons pourra être fait par un laboratoire privé dans le cas des concentratios en sulfate et nitrate. Dans le cas où seul le pH serait analysé, le projet coûterait quelques 12K de moins. Dans ce cas les analyses pourraient être réalisées soit par le personnel en place aux sites ou soit par le personnel localisé à une station précise.

RÉSULTATS PRÉVUS: Cette activité et l'analyse qui en suivra pourront permettre de rationaliser le réseau CAPMON en précisant la variabilité spatiale des ces paramètres. Les résultats obtenus pourront aussi faciliter l'interprétation des données obtenues au stations du réseau CAPMON.

SUBJECT CODE: 2.4.2

PROJECT NUMBER: 122

TITLE: National Air Pollution Surveillance (NAPS) Network - Particulate Sulphates and Nitrates

PRINCIPAL INVESTIGATOR'S NAME: Roger J. Lafleur, Head, Ambient Monitoring Section

AGENCY AND DEPARTMENT: Environment Canada, Environmental Protection Service

ADDRESS: Air Pollution Control Directorate
Pollution Measurement Division
A.P.T.C., River Road
Ottawa, Ontario
K1A 1C8

PHONE: (613) 998-4705

COOPERATING AGENCIES AND INVESTIGATORS: All provincial Departments of the Environment and Environment Canada.

DURATION OF EACH PHASE: Sampling for particulate sulphates and nitrates on a continuing basis began January 1980. Network has been in operation since 1970.

APPROXIMATE COST: Not Available.

OBJECTIVES: To provide measurements in all major Canadian urban areas of particulate sulphate and nitrate levels in order to determine present air quality and to establish long term trends.

METHOD: Suspended particulate matter is collected on glass fibre filters every sixth day at about 110 stations in all major urban areas across Canada by use of the high volume sampler. The collected particulate matter from about 45 stations is analyzed for water-soluble sulphate and nitrate starting January 1980. Total suspended particulate matter and lead are also determined on all filters, this since 1970.

ANTICIPATED RESULTS: Data are entered into the NAPS database.

PROJECT NUMBER: 123

SUBJECT CODE: 2.4.2

TITLE: Atmospheric Aerosol Acidity

PRINCIPAL INVESTIGATOR'S NAME: Dr. H. A. Wiebe

AGENCY AND DEPARTMENT: Atmospheric Environment Service

ADDRESS: 4905 Dufferin Street
Downsview, Ontario
M3H 5T4

PHONE: (416) 667-4797

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: April 1982 - March 1983

APPROXIMATE COST: 14.9K

OBJECTIVES: To measure acidity of atmospheric aerosols and relate to acidic dry deposition patterns in eastern North America.

METHOD: Acidity of atmospheric aerosols will be measured by means of electrochemical titration to yield information on total strong acid content of atmospheric aerosols and the role of ammonia in buffering strong acidic components.

ANTICIPATED RESULTS: Reasonable estimates of acidic dry deposition relevant to LRTAP can be obtained by this method. Strong acid analyses of samples collected during two field trips will be completed by March 1983.

SUBJECT CODE: 2.4.2

PROJECT NUMBER: 124

TITLE: Particulate and Gaseous Sulfur and Nitrogen Compound Sampling Network

PRINCIPAL INVESTIGATOR'S NAME: Dr. Walter Chan

AGENCY AND DEPARTMENT: Ontario Ministry of the Environment, Air Resources Branch

ADDRESS: 880 Bay Street, 4th Floor
Toronto, Ontario
M5S 1Z8

PHONE: (416) 965-1634

COOPERATING AGENCIES AND INVESTIGATORS:

a) Ontario Hydro, Research Division - Mr. O. Melo

b) Atmospheric Environment Services - Dr. L. Barrie

DURATION OF EACH PHASE: Operation 7/80 to at least 3/86

APPROXIMATE COST: $21,000 (4/82-3/83)

OBJECTIVES:

a) To measure particulate sulfate, nitrate and ammonium as well as gaseous SO_2 and HNO_3 on a daily basis (0800-0800)
b) The results of these measurements will be used to determine dry deposition rates associated with air masses having different sectors of origin, to support the interpretation of event precipitation, and to evaluate atmospheric reaction mechanisms associated with LRTAP.

METHOD:

a) At 4 sites, co-located with event precipitation collectors (at Longwoods, Dorset, Charleston Lake & Fernberg) 47 mm low-volume filter packs (25 l.p.m.) are used at a 10 m height to collect samples daily, as follows:
b) Particulates are collected on teflon pre-filters.
c) HNO_3 is collected on nylon filters.
d) SO_2 is collected on W-41 filters impregnated with potassium carbonate-glycerol solution.
e) Analysis is carried out by the MOE-LSB in Toronto.
f) During the measurement program, field intercomparison studies of the network operation with O.H. and AES took place in Jan.-Apr. and July-Oct./81.

ANTICIPATED RESULTS:

a) Data are entered into the MOE database and after editing will be transferred to NAQUADAT, SAROAD and MAP3S databases.
b) Ministry reports are issued to the public after internal review.
c) A review of the MOE data along with similar data obtained by Ontario Hydro and AES networks will be made periodically and a joint publication will hopefully result.

PROJECT NUMBER: 125

SUBJECT CODE: 2.4.2

TITLE: Airborne Particulate and SO_2 Sampling Network

PRINCIPAL INVESTIGATOR'S NAME: Dr. Walter Chan

AGENCY AND DEPARTMENT: Ontario Ministry of the Environment, Air Resources Branch

ADDRESS: 880 Bay Street, 4th Floor
Toronto, Ontario
M5S 1Z8

PHONE: (416) 965-1634

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: Operation 11/81 - 3/86 (at least)

APPROXIMATE COST: $9,700 (4/82-3/83)

OBJECTIVES: To determine long term ambient concentration of various particulate and gaseous compounds.

METHOD:

a) Low volume sampling (2 l.p.m.) over 4-week intervals at 23 sites in Ontario.

b) The prefilter is a Whatman 40 filter for particulate sampling and it is followed by a Nylon filter for HNO_3 sampling and a pair of W41 $K_2CO_3^-$ glycerol impregnated filters for trapping of SO_2.

c) Filters are submitted to MOE-LSB for chemical analysis. The W40 filter samples are analyzed for SO_4, NO_3, NH_4, major ions, nutrients, and trace metals; the Nylon and W41 filters are analyzed for HNO_3 and SO_2 respectively.

ANTICIPATED RESULTS:

a) Data are entered into the MOE database, and after editing will be deposited into NAQUADAT, SAROAD and MAP3S databases.

b) Ministry reports are issued to the public after internal review.

SUBJECT CODE: 2.4.3

PROJECT NUMBER: 126

TITLE: Atmospheric Deposition in the Muskoka-Haliburton Area

PRINCIPAL INVESTIGATOR'S NAME: P. J. Dillon

AGENCY AND DEPARTMENT: Ontario Ministry of the Environment

ADDRESS: Limnology Section, Ont. Min. Environment
P.O. Box 213
Rexdale, Ontario
M9W 5L1

PHONE: (416) 248-3058

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: 5 years

APPROXIMATE COST: $40K/per year

OBJECTIVES: To determine the input rates of strong acid, sulphate, nitrate, major ions and trace metals to lakes and watersheds in Muskoka-Haliburton.

METHOD: Bulk deposition and "wet-only" deposition is measured at 5 sites.

Meteorological information is also collected.

ANTICIPATED RESULTS: Long-term information on atmospheric deposition for use in mass balance modelling.

PROJECT NUMBER: 127

SUBJECT CODE: 2.4.3

TITLE: The Effects of Snow Monitoring to Evaluate Atmospheric Effluents from Mining and Smelting Industries in Northern Manitoba

PRINCIPAL INVESTIGATOR'S NAME: D. L. Wotton

AGENCY AND DEPARTMENT: Environmental Management Division, Department of Consumer and Corporate Affairs and Environment

ADDRESS: Box 7, Building 2
139 Tuxedo Avenue
Winnipeg, Manitoba
R3N 0H6

PHONE: (204) 895-5311

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: (a) March 1980
(b) Continuing

APPROXIMATE COST: For 1982/83: $36,700

OBJECTIVES: To sample snow in selected sites within 40 km of mining smelters at Thompson and Flin Flon and in areas of the province potentially sensitive to the long range transport of air pollutants.

METHOD:

(a) Snow survey networks were established on 7 sites in the Flin Flon area and 12 sites in the Thompson area in 1979. In 1981/82 an additional 44 sites were incorporated throughout the province with particular emphasis in geologically sensitive areas of the precambrian shield.

(b) Snow is analyzed on a priority basis for pH, Acidity, SO_4, NO_3 - NO_2, Conductivity, NH_3, Ca, Mg, Na, Cl, K from all sites. Snow from the 19 sites located in the Flin Flon and Thompson networks is analyzed for the above in addition to the metals; Zn, Ni, Cu, Pb, Fe, Cd.

ANTICIPATED RESULTS:

(a) Identification, quantification and extent of particular contaminants and sulphates present.

(b) Background dispersion information for determination of air pollutant impingement.

(c) Baseline data on snow chemistry for the monitoring of LRTAP.

SUBJECT CODE: 2.4.3

PROJECT NUMBER: 128

TITLE: Chemistry of Winter Precipitation in the Oil Sands Area

PRINCIPAL INVESTIGATOR'S NAME: Ms. B. Magill

AGENCY AND DEPARTMENT: Research Management Division, Alberta Environment

ADDRESS: 14th Floor, Standard Life Centre
10405 Jasper Avenue
Edmonton, Alberta
T5J 3N4

PHONE: (403) 427-3943

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: Commenced in 1981 - ongoing

APPROXIMATE COST: $40,000 (82-83)

OBJECTIVES: The accumulated snowpack in the AOSERP study area is being extensively sampled and chemically analyzed. The concentrations of the ionic and particulate constituents will be determined. Deposition patterns and spatial variability of snowpack loadings are studied to provide baseline data for future industrial development.

METHOD: Contact principal investigator for methodology.

ANTICIPATED RESULTS: Initial data can be obtained from the Research Management Division, Alberta Environment.

PROJECT NUMBER: 129

SUBJECT CODE: 2.4.3

TITLE: Long Term Measurement of the Acidification on Non-Cultivated Soil in Alberta

PRINCIPAL INVESTIGATOR'S NAME: Dr. H. Regier

AGENCY AND DEPARTMENT: Technical Development Branch, Earth Sciences Division, Alberta Environment

ADDRESS: Box 3014
Cousins Building
Lethbridge, Alberta
T1J 4C7

PHONE: (403) 229-5322

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: Commenced in 1981

APPROXIMATE COST: $81,000 (82-83)

OBJECTIVES: The project is to be a long term monitoring of acid sensitive, non-cultivated soils located in areas of Alberta where deposition of acid precursors is expected to be high.

METHOD: Contact principal investigator.

ANTICIPATED RESULTS: Data from four sites will be available in 1983 from the Earth Sciences Division, Alberta Environment.

SUBJECT CODE: 2.4.3

PROJECT NUMBER: 130

TITLE: Precipitation Quality Data Summary

PRINCIPAL INVESTIGATOR'S NAME: J. Torneby

AGENCY AND DEPARTMENT: Air Quality Branch, Pollution Control Division, Alberta Environment

ADDRESS: 6th Floor, Oxbridge Place
9820 - 106 Street
Edmonton, Alberta
T5K 2J6

PHONE: (403) 427-5893

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: January to December, annually.

APPROXIMATE COST: $20,000 (82-83)

OBJECTIVES: The chemical composition of precipitation is monitored at several permanent sites in Alberta. The objective of the programme is to detect significant changes resulting from industrialization and to provide an historical data base.

METHOD: Contact principal investigator for project methodology.

ANTICIPATED RESULTS: Data reports are produced annually and are available from the Air Quality Control Branch, Pollution Control Division, Alberta Environment.

PROJECT NUMBER: 131

SUBJECT CODE: 2.4.3

TITLE: Air and Precipitation Network (APN)

PRINCIPAL INVESTIGATOR'S NAME: Dr. L. A. Barrie

AGENCY AND DEPARTMENT: Atmospheric Environment Service

ADDRESS: 4905 Dufferin Street
Downsview, Ontario

PHONE: (416) 667-4785

COOPERATING AGENCIES AND INVESTIGATORS: M. Still, Dr. A. Wiebe, P. Fellin
Atmospheric Environment Service

DURATION OF EACH PHASE: On-going.

APPROXIMATE COST: 119.9K 82/83

OBJECTIVES: To determine the chemical composition of daily precipitation and average concentrations of sulphur dioxide and particulate major ions in Canada.

METHOD: Sampling sites (8 in operation) were selected to provide regionally representative precipitation samples, and where possible to complement other studies at calibrated watersheds in eastern Canada.

Each station in the network has a Sangamo wet-only precipitation sampler (24-hour samples), rain and snow gauge, low volume filter system which samples the air mass for particulates and vapour phase SO_2 on a daily basis.

ANTICIPATED RESULTS: Provision of daily sampling results for stations in Canada in a regularly published report. Network will be integrated into a single Canadian network, CAPMoN, (March 1983).

SUBJECT CODE: 2.4.3

PROJECT NUMBER: I32

TITLE: Snow sampling in South Central British Columbia

PRINCIPAL INVESTIGATOR'S NAME: M. S. Kotturi

AGENCY AND DEPARTMENT: Ministry of Environment/Air Studies Branch

ADDRESS: Air Studies Branch
Ministry of Environment
Parliament Buildings
Victoria, B.C.
V8V 1X5

PHONE: (604) 387-5888

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: 04/80 to 04/83

APPROXIMATE COST: $5,000

OBJECTIVES: Acidity and Chemical Composition of South Central British Columbia Snow Pack.

METHOD: Snow core samples are being taken once per year in South Central British Columbia, at 12 to 16 sites. Samples analysed for pH, total acidity and strong acidity, SO_4, NO_3, Cl, F, PO_4, NH_4, Na, K, Ca, Mg, and Al.

ANTICIPATED RESULTS: Illustration of background acidity of snow at elevated sites in south-central British Columbia.

PROJECT NUMBER: 133

SUBJECT CODE: 2.4.3

TITLE: Atmospheric Monitoring Research and Development

PRINCIPAL INVESTIGATOR'S NAME: M. Still, P. Fellin, Dr. L. Barrie

AGENCY AND DEPARTMENT: Atmospheric Environment Service

ADDRESS: 4905 Dufferin Street
Downsview, Ontario

PHONE: (416) 667-4988 (Still)
(416) 667-4965 (Fellin)
(416) 667-4785 (Barrie)

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: On-going

APPROXIMATE COST: 81.0K 82/83

OBJECTIVES: To maintain expertise in precipitation quality monitoring techniques, determine precipitation sample integrity, conduct filter testing and evaluation, and to analyse and interpet monitoring network data.

METHOD:

1. Measurement methods and instruments are monitored, evaluated and field tested against standard equipments.
2. At regionally representative sites, duplicate samplers monitor precipitation and an evaluation is being made on influence of seasonal effects, analysis time and storage conditions on major ions and pH.
3. Filter sampling techniques are tested under field conditions to determine sampling efficiency under a variety of environmental conditions.
4. Statistical and meterological techniques are used to analyze network databases.

ANTICIPATED RESULTS: Aid the development of an improved monitoring network. To provide leadership in the field of air and precipitation monitoring in Canada.

SUBJECT CODE: 2.4.3

PROJECT NUMBER: 134

TITLE: Inventory of Precipitation Chemistry Stations in the Atlantic Provinces

PRINCIPAL INVESTIGATOR'S NAME: B. L. Taylor

AGENCY AND DEPARTMENT: Atmospheric Environment Service - Atlantic Region

ADDRESS: 1496 Bedford Highway
Bedford, Nova Scotia
B4A 1E5

PHONE: (902) 835-9529

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: April 1982 - March 1983

APPROXIMATE COST:

OBJECTIVES: To prepare an inventory of past and current precipitation chemistry stations in the Atlantic provinces.

METHOD: A listing of precipitation chemistry stations in both provincial and federal networks in the Atlantic provinces is compiled, indicating elements sampled and the period of data in each case.

ANTICIPATED RESULTS: An inventory was distributed in June 1982. An update will be provided at the fall 1982 Atlantic LRTAP Workshop.

PROJECT NUMBER: 135

SUBJECT CODE: 2.4.3

TITLE: Canadian Air and Precipitation Monitoring Network (CAPMON)

PRINCIPAL INVESTIGATOR'S NAME: M. Still

AGENCY AND DEPARTMENT: Atmospheric Environment Service

ADDRESS: 4905 Dufferin Street
Downsview, Ontario

PHONE: (416) 667-4988

COOPERATING AGENCIES AND INVESTIGATORS: Dr. J. Young, Dr. L. Barrie
Atmospheric Environment Service

DURATION OF EACH PHASE: On-going

APPROXIMATE COST: 415.6K 82/83

OBJECTIVES: To review, upgrade and integrate the present air quality networks - CANSAP, APN, CAASN (Canadian Arctic Aerosol Sampling Network), BAPMON (WMO Background Air Pollution Monitoring Network).

METHOD: Work program for the implementation of CAPMoN consists of 3 parts:

1. Site inspection and installation.
2. Instrument modification.
3. Quality assurance program development

The current 54 site CANSAP network becomes 50 site CAPMON network starting 1983-84 fiscal year.

ANTICIPATED RESULTS: To develop an improved, integrated Canadian network set of standard monitors to ensure compatibility of air and precipitation measurements. Upgraded network will commence east of the Manitoba-Saskatchewan border March 1983.

SUBJECT CODE: 2.4.3

PROJECT NUMBER: 136

TITLE: Canadian Arctic Air Pollution Program (CAAPP)

PRINCIPAL INVESTIGATOR'S NAME: Dr. L. A. Barrie

AGENCY AND DEPARTMENT: Atmospheric Environment Service

ADDRESS:

PHONE: (416) 667-4785

COOPERATING AGENCIES AND INVESTIGATORS: CAAPP is part of an international effort involving Canada, U.S.A., Norway, Denmark, Iceland and the U.K.

DURATION OF EACH PHASE: On-going

APPROXIMATE COST: 4.9K 82/83

OBJECTIVES: To study trends and causes of haziness in the arctic during the winter months.

METHOD: CAAPP is into its third year of operation at three sites in the Canadian High Arctic: Igloolik, Mould Bay and Alert. It involves high volume filter sampling at all sites and integrating nepholometer measurements of light scattering at Mould Bay and Igloolik.

CAAPP is undergoing program review this year to evaluate the need for further monitoring in future years and will be integrated into the overall CAPMoN network.

ANTICIPATED RESULTS: First results from the program have been published in Atmospheric Environment. The program has shown that relatively high levels of sulphate and other orthropogenic aerosols are reaching for into the Arctic from mid-latitudinal sources.

PROJECT NUMBER: 137

SUBJECT CODE: 2.4.3

TITLE: Study of the Effects of Long Range Pollutants on the Domestic Environment

PRINCIPAL INVESTIGATOR'S NAME: T. Smith-Palmer
J. C. Donini

AGENCY AND DEPARTMENT: St. Francis Xavier University

ADDRESS: Antigonish, N.S.
B2G 1C0

PHONE: (902) 867-2124

COOPERATING AGENCIES AND INVESTIGATORS: Dr. T. Khan, Health & Welfare Canada

DURATION OF EACH PHASE: 10/82 - 2/83

APPROXIMATE COST: 10/82 - 2/83 $22,000

OBJECTIVES:

a) Measurement of concentration of free hydrogen ion, sulfate ion and nitrate ion, mainly in Antigonish County. An attempt will be made to ascertain the counter-ion distribution for these species.

b) Estimation of contribution from sea spray.

c) Partitioning of loading between local and long range pollutants.

METHOD:

a) Simultaneous sampling is conducted inside and outside domestic residences to estimate the effect on health.

b) Aerosol samples are fractionated by cyclone into particles with diameters greater than and less than 15u, and only the smaller particles are analysed.

c) FPD is used for sulphate analysis, I.C. for nitrate analysis, and titrimetry for acidity.

ANTICIPATED RESULTS: Demonstration of the effect of long range pollutants on the domestic environment.

SUBJECT CODE: 2.4.3

PROJECT NUMBER: 138

TITLE: Analysis of Air and Precipitation Chemistry Data from an Atlantic Canada Site

PRINCIPAL INVESTIGATOR'S NAME: B. L. Taylor

AGENCY AND DEPARTMENT: Atmospheric Environment Service, Environment Canada

ADDRESS: 1496 Bedford Highway
Bedford, Nova Scotia
B4A 1E5

PHONE: (902) 835-9529

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: Beginning January 1983 until March 1984

APPROXIMATE COST:

OBJECTIVES: To produce statistics on the origin and deposition of pollutants at Kejimkujik National Park, N.S.

METHOD: Air and precipitation chemistry data from the APN station at Kejimkujik National Park, N.S., will be analyzed to produce statistics on the concentration and deposition of various pollutants.

Trajectory analyses will be used to determine the origin of the pollutants.

ANTICIPATED RESULTS:

NUMÉRO DE PROJET: 139

CODE DU SUJET: 2.4.3

TITRE: Analyse des données APN de Forêt Montmorency

NOM DU CHERCHEUR RESPONSABLE:

MINISTÈRE, ORGANISME OU ORGANISME PRIVÉ, SERVICE: Service de l'Environnement atmosphérique
Région du Québec

ADRESSE: 100, boul. Alexis Nihon
Ville St-Laurent, Québec
H4M 2N8

TÉLÉPHONE: (514) 333-3020

COLLABORATEUR(S), ORGANISME(S) ET CHERCHEUR(S):

DURÉE DE CHAQUE PHASE:

COÛT APPROXIMATIF: $1K

OBJECTIFS DE TRAVAIL: Analyse des données de concentration et de dépôts humides de la station APN colligées en 1981 en fonction des rétrotrajectoires atmosphériques.

MÉTHODE DE TRAVAIL: Les rétrotrajectoires atmosphériques seront obtenues à l'aide du modèle d'Olson et des relations statistiques seront dérivées entre ces rétrotrajectoires et les données recueillies à la station APN en 1981. Si possible, ces données seront aussi analysées en fonction des patrons de circulations synoptiques. La possibilité de traiter les données de d'autres stations APN limitrophes sera aussi considérée.

RÉSULTATS PRÉVUS: Une meilleure connaissance des processus atmosphériques de transport sur de grandes distances affectant le Québec et la possibilité de développer un outil simple de prévision des évènements acides.

CODE DU SUJET: 2.5.1

NUMÉRO DE PROJET: 140

TITRE: Développement d'un modèle numérique pouvant estimer le transport à grande distance des composés du soufre.

NOM DU CHERCHEUR RESPONSABLE: Dr. Jean-Pierre Fortin

MINISTÈRE, ORGANISME OU ORGANISME PRIVÉ, SERVICE: INRS-Eau (Université du Québec)

ADRESSE: C.P. 7500
Sainte-Foy (Québec)
G1V 4C7

TÉLÉPHONE: (418) 657-2281

COLLABORATEUR(S), ORGANISME(S) ET CHERCHEUR(S): Environnement Québec, Service de l'assainissement de l'air Monsieur Claude Lelièvre

DURÉE DE CHAQUE PHASE: Développement du modèle: 81/09 à 83/01

COÛT APPROXIMATIF: Du 81/09 au 83/01: $52,820

OBJECTIFS DE TRAVAIL: Développement d'un modèle numérique d'estimation du transport à grande distance des composés du soufre.

MÉTHODE DE TRAVAIL: a) identification des divers phénomènes atmosphériques qui doivent être considérés dans le domaine des précipitations acides; b) revision critique des divers modèles de transport de polluants à longue distance; c) développement d'un modèle tenant compte de a) et b), des données disponibles actuellement ou dans un avenir proche, de la précision escomptée et de la rapidité d'exécution sur ordinateur; d) compilation des taux moyens tant annuels que saisonniers d'émissions de composés du soufre dans l'atmosphère par certaines sources ponctuelles.

RÉSULTATS PRÉVUS: Détermination de la contribution relative de certaines sources émettrices ponctuelles québécoises sur les bilans annuels, sinon saisonniers, des composés du soufre ainsi que leur incidence sur les précipitations acides au Québec.

PROJECT NUMBER: 141

SUBJECT CODE: 2.5.1

TITLE: Annual Estimates of Ontario Hydro Contributions to Acid Deposition

PRINCIPAL INVESTIGATOR'S NAME: D. K. Gillies

AGENCY AND DEPARTMENT: Environmental Protection Dept.: Central Thermal Services
Ontario Hydro

ADDRESS: 700 University Avenue
Toronto, Ontario
M5C 1X6

PHONE: (416) 592-4647

COOPERATING AGENCIES AND INVESTIGATORS: ACRES Consulting Services Ltd.
Mr. P. Denison

DURATION OF EACH PHASE: 05/83 - 10/83

APPROXIMATE COST: $15,000 (07/81 - 07/82)

OBJECTIVES:

a) Estimate the levels of wet, dry and total sulphate, nitrate and hydrogen ion equivalents at receptor points within eight sensitive receptor areas in and around Ontario.

b) Estimate Ontario Hydro's relative contribution to H^+ in each area.

METHOD:

a) Utilize ACRES "Box" model - phase I.

b) Utilize other statistical/lagrangian models as available - phase II.

ANTICIPATED RESULTS: Estimation of Ontario Hydro's relative (percentage) contribution to acid deposition in sensitive areas due to the annual acid gas emissions from its coal-fired generating stations.

SUBJECT CODE: 2.5.1

PROJECT NUMBER: 142

TITLE: Modelling of Long Range Transport and Acidic Depositions

PRINCIPAL INVESTIGATOR'S NAME: R. Portelli

AGENCY AND DEPARTMENT: Concord Scientific

ADDRESS: 2 Tippett Road
Downsview, Ontario

PHONE: (416) 630-6331

COOPERATING AGENCIES AND INVESTIGATORS: A.C. McMillan, Ontario Hydro Research Division
CEA funded

DURATION OF EACH PHASE: Phase 1 - complete October 1983

APPROXIMATE COST:

OBJECTIVES:

(1) Evaluate statistical long range transport models according to a rigorous protocol, both on the model's scientific basis and capability to simulate measurements.

(2) Design a more general modular model format for use in successive modelling activities.

METHOD:

(1) Survey literature to assemble all relevant models and data sets.

(2) Evaluate models against a set of criteria.

(3) Implement the most promising models and analyze the results.

(4) Give particular attention to the computer aspects of the work so that user-friendly software is produced.

ANTICIPATED RESULTS: Implementation of long range transport modelling facility for use of CEA members, supported by analysis of alternatives.

PROJECT NUMBER: 143

SUBJECT CODE: 2.5.2

TITLE: Advanced Chemistry Model

PRINCIPAL INVESTIGATOR'S NAME: Dr. J. Bottenheim

AGENCY AND DEPARTMENT: Atmospheric Environment Service

ADDRESS: 4905 Dufferin Street
Downsview, Ontario

PHONE: (416) 667-4778

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: Phase 1 - 1982-83
Phase 2 - 1983-84

APPROXIMATE COST: 5.0K 82/83

OBJECTIVES: To determine the feasibility and need of detailed parameterizations in the concentration sub-model of the AES-LRT Lagrangian model.

METHOD: Phase 1- NOx-PAN chemistry to be added to chemical model. Seasonal variations of source terms will be added as well as duirnal variation of sunlight dependent reactions. Model will be made temperature dependent, and include simplified cloud chemistry model, and improved washout model. No direct NOx-SOx interaction is considered.

Phase 2- A more sophisticated chemical model will be developed including full interaction between NOx-SOx hydrocarbons. Model uses Gear-integration method.

ANTICIPATED RESULTS: A sophisticated model will be developed to address important atmospheric (NOx etc.) chemistry and non-linear processes.

SUBJECT CODE: 2.5.2

PROJECT NUMBER: 144

TITLE: Trajectory Analysis of Precipitation Chemistry Events in Northeastern Alberta

PRINCIPAL INVESTIGATOR'S NAME: P.J. Kocuiba

AGENCY AND DEPARTMENT: Atmospheric Environment Service

ADDRESS: Western Regional Offices
Argyll Centre
6325-103 Street
Edmonton, Alberta
T6H 5H6

PHONE: (403) 437-1250

COOPERATING AGENCIES AND INVESTIGATORS: M. P. Olson, AES, Downsview

DURATION OF EACH PHASE:

APPROXIMATE COST: 14.0K 82/83

OBJECTIVES: To evaluate relationships between air trajectories and precipitation chemistry; develop computer techniques for calculating 6 and 12 hour back trajectories; propose physical processes which may be the primary cause of precipitation chemistry events.

METHOD: In order to establish whether there is a relationship between regional emissions and precipitation chemistry, air trajectories are calculated for each event where pH and sulphate concentrations of the sample are outside the range of defined background conditions. 1976-81 precipitation chemistry data is reviewed, and where pH is less than 4.8 and sulphate concentration is greater than 1.5 mg/l air trajectories are calculated for 6 and 12 hours before the event.

ANTICIPATED RESULTS: A preliminary report has been prepared by Olson and McGill dealing with precipitation chemistry statistics in the Alberta Oil Sands area. A narrative description of each case considering all constituents, nature of the precipitation and trajectory is planned for December 1982.

PROJECT NUMBER: 145

SUBJECT CODE: 2.5.2

TITLE: Acid Deposition Model Application to Western Canada

PRINCIPAL INVESTIGATOR'S NAME: P.J. Kocuiba

AGENCY AND DEPARTMENT: Atmospheric Environment Service

ADDRESS: Western Regional Offices
Argyll Centre
6325-103 Street
Edmonton Alberta
T6H 5H6

PHONE: (403) 437-1250

COOPERATING AGENCIES AND INVESTIGATORS: M.P. Olson, AES, Downsview, Ontario
Also, AES Scientific Services Divisions in Central and Pacific Regions

DURATION OF EACH PHASE: January 1982 - March 1984

APPROXIMATE COST: 50.2K 82/83

OBJECTIVES: To apply the AES LRTAP trajectory model to western Canada.

METHOD: A pilot project to apply the AES trajectory deposition model to western Canada was undertaken jointly by the three western AES regional offices (Central, Western and Pacific). Further development includes testing the model for seasons other than summer, evaluating model results in mountainous areas and deriving deposition patterns for northern Canada.

ANTICIPATED RESULTS: A paper describing model results - derived trajectories for 1978 and deposition for July 1978 - were presented at the symposium on "Acid Forming Emissions in Alberta" in March 1982.

SUBJECT CODE: 2.5.2

PROJECT NUMBER: 146

TITLE: Regional Transport and Transformation Modelling

PRINCIPAL INVESTIGATOR'S NAME: M. Olson, Dr. E. Voldner

AGENCY AND DEPARTMENT: Atmospheric Environment Service, Environment Canada

ADDRESS: 4905 Dufferin Street
Downsview, Ontario
M3H 5T4

PHONE: (416) 667-4903

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: On-going

APPROXIMATE COST: 6.3K 82/83

OBJECTIVES: To develop, improve and evaluate trajectory and Lagrangian concentration/deposition models suitable for applications in the study of the long-range transport of air pollutant processes.

METHOD: The trajectory model computes multi-level air parcel trajectories, below 100mb, forward or backward, from any point in North America, using an iterative technique with variable grid scales, trajectory duration and time-steps.

The Lagrangian concentration/deposition model simulates the movement of an air parcel along trajectories either towards a receptor or away from a pollutant source. The model simulates pollutant input from an inventory, linear chemical transformation and dry/wet deposition of pollutant mass. It shows concentration/deposition patterns on a monthly to annual basis throughout North America and also produces sulphur budgets and source-receptor relationships.

ANTICIPATED RESULTS: Compute trajectories to meet various agency requests.
Updated sulphur and nitrogen inventories.
Compute transfer matrices, sulphur concentration/deposition patterns, sulphur budgets, model evaluations.
Reports prepared for presentation and publication.

PROJECT NUMBER: 147

SUBJECT CODE: 2.5.2

TITLE: LRTAP Modelling - MEP-LRT Trans Model

PRINCIPAL INVESTIGATOR'S NAME: Dr. J.W.S. Young

AGENCY AND DEPARTMENT: Atmospheric Environment Service

ADDRESS: 4905 Dufferin Street
Downsview, Ontario
M3H 5T4

PHONE: (416) 667-4610

COOPERATING AGENCIES AND INVESTIGATORS: MEP Company
Downsview, Ontario

DURATION OF EACH PHASE: January - April 1982

APPROXIMATE COST: 40.0K

OBJECTIVES: To complete Canada - U.S. Memorandum of Intent (MOI) Atmospheric Sciences Working Group 2. Phase 3 products using a non-governmental LRTAP modeller.

METHOD: MEP Company's LRT-TRANS model is used to represent Canada in MOI process. Activities include:

1. implementation of modified emissions inventory
2. model input verification tests
3. revised model profile
4. model evaluation
5. improvements to wet deposition formulation
6. separate concentration and loading plots for U.S. and Canada
7. revised graphics display capabilities

ANTICIPATED RESULTS: Completed MOI Phase 3 products including updated model profile report and slides on modelling.

SUBJECT CODE: 2.5.3

PROJECT NUMBER: 148

TITLE: LRTAP Eulerian Model

PRINCIPAL INVESTIGATOR'S NAME: M. Olson, Dr. D. Davies (RPN)

AGENCY AND DEPARTMENT: Atmospheric Environment Service

ADDRESS: 4905 Dufferin Street
Downsview, Ontario
M3H 5T4

PHONE: (416) 667-4903

COOPERATING AGENCIES AND INVESTIGATORS:

1. Ontario Ministry of the Environment, (OME) Toronto, Ontario
2. MEP Company, Toronto, Ontario
3. ERT Company, Boston, Mass.

DURATION OF EACH PHASE: Phase 1 - completion March 1984.

APPROXIMATE COST: 44.8K 82/83

OBJECTIVES: To develop and implement a "national" Eulerian air pollution model on several time and space scales with diagnostic and prognostic capabilities over the North American domain.

METHOD:

1. 5-year planning document outlining proposed work plan for design and implementation, in stages, has been developed and initiated with programming in phase 1.
2. The model will be developed jointly by RPN (Montreal) and OME in co-operation with MEP Co. & ERT Co. as consulting agencies and a work group has been formed.
3. The model will utilize multiple levels of analyzed meteorological data from CMC, employ the most suitable numerical methods and latest programming techniques available.

ANTICIPATED RESULTS: The advanced model will provide the basis for realtime forecasting and for supporting international pollution control agreements. A working version is planned in 2 years time and will be suitable for use on the new vector computer at CMC in Montreal.

PROJECT NUMBER: 149

SUBJECT CODE: 2.5.4

TITLE: Wet and Dry Deposition Predictions for Selected Point Sources

PRINCIPAL INVESTIGATOR'S NAME: Mr. R. Angle

AGENCY AND DEPARTMENT: Air Quality Branch, Pollution Control Division, Alberta Environment

ADDRESS: 6th Floor, Oxbridge Place
9820 - 106 Street
Edmonton, Alberta
T5K 2J6

PHONE: (403) 427-5893

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: Ongoing

APPROXIMATE COST: $2,000 (82-83)

OBJECTIVES: As required, a computer model is used to determine the depositional pattern of wet and dry sulphur. Seasonal and annual estimates of deposition amounts within 100 km of any point source are made.

METHOD: Contact principal investigator for project procedures.

ANTICIPATED RESULTS: Maps and tabulations can be provided by the Pollution Control Division, Alberta Environment.

SUBJECT CODE: 2.5.4

PROJECT NUMBER: 150

TITLE: Trajectory Analysis of Air Flowing over Newfoundland

PRINCIPAL INVESTIGATOR'S NAME: B.L. Taylor

AGENCY AND DEPARTMENT: Atmospheric Environment Service,
Field Services Directorate

ADDRESS: Atlantic Regional Offices
1496 Bedford Highway
Bedford, N.S.
B4A 1E5

PHONE: (902) 835-9529

COOPERATING AGENCIES AND INVESTIGATORS: Atmospheric Research Directorate, AES
Newfoundland Provincial Government

DURATION OF EACH PHASE: April 1982 - March 1983

APPROXIMATE COST:

OBJECTIVES: To provide statistics on the passage of air over Newfoundland from two power plant sites in the Maritimes.

METHOD: Using a trajectory analysis program, forward trajectory positions are determined. Statistics will be generated using a program developed to analyze the output of the trajectory analysis.

ANTICIPATED RESULTS: Forward trajectory positions have been produced for one full year. A program to read and decode the data has been written and tested.

SECTION 3

EFFECTS STUDIES

SUBJECT CODE: 3.1.1

PROJECT NUMBER: 151

TITLE: The Role of Microbial Nitrate Reduction in Modifying pH Reduction in a Lake Being Experimentally Acidified by Additon of HNO_3

PRINCIPAL INVESTIGATOR'S NAME: John W.M. Rudd

AGENCY AND DEPARTMENT: Department of Fisheries and Oceans

ADDRESS: Freshwater Institute
501 University Crescent
Winnipeg, Manitoba
R3T 2N6

PHONE: (204) 269-7379

COOPERATING AGENCIES AND INVESTIGATORS: N. Loewen
University of Manitoba

DURATION OF EACH PHASE: April 1, 1981 - March 31, 1986

APPROXIMATE COST: 82/83 - 21 83/84 - 33.5

OBJECTIVES: To determine the importance of alkalinity production by microbial nitrate reducing activities in lakes including photosynthetic and bacterial nitrate reduction.
To determine the effects of reduced pH and elevated NO_3^- and NH_4^+ concentrations on rates of N_2O production.

METHOD: Bacterial nitrate reduction rates will be assayed by a 15N technique using a mass spectrometer.
Experiments will be done in intact cores, by laboratory incubations of lake sediment and by experiments in large in situ enclosures.
Whole lake denitrification rates will be estimated by mass balance calculation and by isotopic analyses of sedimented organic material.

ANTICIPATED RESULTS: Reduction of nitrate either by bacterial denitrification or by algal photosynthesis results in an increase in alkalinity thus modifying pH reduction resulting from acid precipitation. Bacterial denitrification is a permanent alkalinity increase since the N_2 and N_2O produced escapes to the atmosphere. Burial of photosynthetically reduced nitrate may not be permanent if the reduced nitrogen is regenerated by microbial decomposition.
The experiments outlined above will be carried out in Lake 302 which is being experimentally acidified by addition of HNO_3. Mass balance calculation will give whole lake nitrate reduction rates. Heavy isotope and bacterial assays of denitrification will be indicative of the relative importance of denitrification vs. permanent burial of photo synthetically reduced nitrate. Experiments on controlling rates of denitrification will establish limits for this type of microbial alkalinity producing activity.

PROJECT NUMBER: 152

SUBJECT CODE: 3.1.1

TITLE: Background Concentration Levels of Trace Metals in Shield-Type Lakes

PRINCIPAL INVESTIGATOR'S NAME: R. Wagemann

AGENCY AND DEPARTMENT: Department of Fisheries and Oceans

ADDRESS: Freshwater Institute
501 University Crescent
Winnipeg, Manitoba
R3T 2N6

PHONE: (204) 269-7379

COOPERATING AGENCIES AND INVESTIGATORS: D. W. Schindler,
Freshwater Institute
Winnipeg, Manitoba

DURATION OF EACH PHASE: Has been combined with another project viz. ELA acidification project.

APPROXIMATE COST: $5000 per year exclusive of salaries and transportation costs

OBJECTIVES: (a) To establish background concentration levels of trace metals in Shield-type lakes of the Experimental Lakes Area while still relatively pristine and unaffected by atmospheric pollution.

(b) To provide a benchmark for assessing the influence of acidic inputs on metal regimes of Shield-type lakes.

METHOD: Large volume samples (20L) are collected in plastic carboys, filtered (0.2 um) and acidified with ultra-pure acid, preconcentrated to 700 ml in a quartz still and analyzed by flameless AA or emission spectrometry for Al, Cd, Co, Cr, Cu, Fe, Mn, Pb, Zn. Sample containers and apparatuses used in connection with filtration and preconcentrations are rigorously cleaned before use.

ANTICIPATED RESULTS: Data will be evaluated and discussed, and put into a technical report, or hopefully published in a scientific journal.

SUBJECT CODE: 3.1.1

PROJECT NUMBER: 153

TITLE: Surface Water Monitoring for LRTAP Assessment

PRINCIPAL INVESTIGATOR'S NAME: Peter Brooksbank

AGENCY AND DEPARTMENT: Department of Environment, Inland Waters Directorate

ADDRESS: Water Quality Branch, 10th Floor
Place Vincent Massey
Ottawa, Ontario
K1A 0E7

PHONE: (613) 997-3422

COOPERATING AGENCIES AND INVESTIGATORS: Ontario Ministry of the Environment

DURATION OF EACH PHASE: Ongoing

APPROXIMATE COST: FY 83/84 1.0 PY, 25K O&M

OBJECTIVES: To develop a surface water chemistry monitor network for Ontario, Quebec and Atlantic Regions, capable of defining rates of change in aquatic regime major ion and trace metal content.

METHOD: A monitoring network will be in place in Ontario, Quebec and the Atlantic Region by April 1st, 1983. Water samples from Quebec stations and Atlantic Region stations will be analyzed by Water Quality Branch Laboratories. In Ontario, the network will use data collected by other agencies. All the data will be stored on NAQUADAT.

ANTICIPATED RESULTS: Will provide good quality controlled data, suitable for assessing the long-term trends in water quality related to the LRTAP Program.

PROJECT NUMBER: 154

SUBJECT CODE: 3.1.1

TITLE: Resurvey of Yarmouth Co. Lakes

PRINCIPAL INVESTIGATOR'S NAME: T.A. Clair

AGENCY AND DEPARTMENT: Water Quality Branch, IWD, Environment Canada

ADDRESS: P.O. Box 861
Moncton, New Brunswick
E1C 8N6

PHONE: (506) 388-6606

COOPERATING AGENCIES AND INVESTIGATORS: N/A

DURATION OF EACH PHASE: Two Months

APPROXIMATE COST: $10,000 O&M

OBJECTIVES: This study fulfills the ECS goal of studying long term trends and of delineating areas of sensitivity.

METHOD: A number of lakes for which there is data from the early 1970's will be resampled and the data from both surveys will be compared using ANOVA techniques.

ANTICIPATED RESULTS: A report describing changes in water quality in an area impacted by acidic precipitation will be produced by late 1983.

SUBJECT CODE: 3.1.1

PROJECT NUMBER: 155

TITLE: Ontario Headwater Lakes Assessment
(part of a National Inventory Program)

PRINCIPAL INVESTIGATOR'S NAME: Dr. John R.M. Kelso

AGENCY AND DEPARTMENT: Dept. of Fisheries and Oceans
Great Lakes Fisheries Research Branch

ADDRESS: 1219 Queen Street East
Sault Ste. Marie, Ontario

PHONE: (705) 942-2848

COOPERATING AGENCIES AND INVESTIGATORS: Ontario Ministry of Natural Resources, National Water Research Institute

DURATION OF EACH PHASE: 1981-1986

APPROXIMATE COST:

81/82	82/83	83/84
93.3K	62.8K	92.8K

OBJECTIVES:

1) To determine chemical and biological status of sensitive lakes in eastern Canada (Ontario).
2) To provide a benchmark against which rate of change measurements can be applied to determine regional change and/or susceptibility.
3) To provide a benchmark against which change can be measured.
4) To determine regional distribution of toxic metals and organics in fish.

METHOD: Across Ontario, 180 lakes were sampled using a lake sampling methodology developed in 1979 (Kelso, et al 1981). Buffer related chemical tests, metals in water and fish were examined. Community structure was determined for phytoplankton, zooplankton, benthos and fish in a subset of lakes. For fish community structure, age class structure and growth are examined in addition to total body lipid, metal and organic body burdens.

ANTICIPATED RESULTS:

1) When combined with data similarly collected in Quebec, Labrador, Newfoundland, New Brunswick and Nova Scotia, a description of lake status and fish response will be available for eastern Canada.
2) A data set will be available against which to apply models of lake response.
3) Re-examination of lakes should provide evidence of response under extant loadings.
4) Condition of fish re human consumption is poorly understood in inland lakes. The survey will examine many species in lakes where only natural/airborne materials dominate.

PROJECT NUMBER: 156

SUBJECT CODE: 3.1.1

TITLE: Acid Rain Sensitivity Survey of Potential Atlantic Salmon Enhancement Rivers in Nfld.

PRINCIPAL INVESTIGATOR'S NAME: W.J. Bruce
D. Scruton

AGENCY AND DEPARTMENT: Fisheries Research Branch
Fisheries and Oceans

ADDRESS: P.O. Box 5667
St. John's, Newfoundland
A1C 5X1

PHONE: (709) 772-2128
-4485

COOPERATING AGENCIES AND INVESTIGATORS: Water Analysis Facility (WAF)
Memorial University of Newfoundland

DURATION OF EACH PHASE: May 1981 - May 1982
Fall 1982 - Spring 1983

APPROXIMATE COST: May 1981 - May 1982 $70K Fall 82/Spring 83 $20K

OBJECTIVES:

a) To determine sensitivity of selected Atlantic salmon enhancement rivers in Newfoundland and determine whether they are presently being impacted by acid rain;

b) To determine buffering capacity of these river systems for future impacts;

c) To determine maximum pH depressions during fall rains and spring run-off of selected rivers in most sensitive areas.

METHOD:

a) Monthly water sampling of some 20 Atlantic salmon rivers for pH, major ions and trace metals;

b) More frequent (bi-monthly) water sampling during the rainy fall period and the spring run-off.

ANTICIPATED RESULTS:

a) Results will show whether any of the planned enhancement rivers are presently being impacted by acid rain and help salmon resource managers choose the best rivers for Atlantic salmon enhancement;

b) Establish a bench mark for water quality of these rivers which can be re-examined at some future date to measure changes resulting from acid rain;

c) Comparing rivers in different geological zones will help determine if bedrock geology is a good indicator of water quality in Newfoundland Region and what effect glacial drift has on water quality.

SUBJECT CODE: 3.1.1

PROJECT NUMBER: 157

TITLE: Kejimkujik Watersheds Study. Baseline Characterization, Biological Effects and Chemical Mass Balance. Analysis and Write Up.

PRINCIPAL INVESTIGATOR'S NAME: J.J. Kerekes

AGENCY AND DEPARTMENT: Environment Canada, Canadian Wildlife Service, Atlantic Region

ADDRESS: c/o Biology Department
Dalhousie University
Halifax, Nova Scotia

PHONE: (902) 426-6356

COOPERATING AGENCIES AND INVESTIGATORS:
Inland Water Directorate
Atmospheric Environment Services
P. Lane, Dalhousie
B. Freedman, Dalhousie

DURATION OF EACH PHASE:

APPROXIMATE COST: 1983/84 10K

OBJECTIVES: Quantify the effects of LRTAP on the hydrogeochemistry of KWS by constructing lake mass-balances, quantify the effects on the biota and assessing long and short-term trends for events in the acidification.

METHOD: Using CANSAP and APN data, determine atmospheric loading and by combining water chemistry and discharge data calculate export of ions from inlets and outlets. Calculate mass balances for each watershed. Using completed reports on the status of the biota (phytoplankton, zooplankton, macrophytes, planktonic primary production, invertebrates) on the study lakes prepare a synthesis report on LRTAP effects on the biota.

ANTICIPATED RESULTS:
Chemical mass balances for 1978/79, 1979/80, 1980/81 has been published.
Report on the chemical mass balance for 1981/82 in 1983.
Report on seasonal trends of major ions in 1983.
Modify the Henriksen and Thompson models to incorporate organic acids in 1983.
Limnological conditions in three lakes in 1983.
Report on chemical mass balance for 1982/83 in 1984.
Report on the effects of LRTAP on the biota in 1984.
Summary report on chemical mass balances and seasonal trends in 1985.

PROJECT NUMBER: 158

SUBJECT CODE: 3.1.1

TITLE: Stable Isotope Study of Sulfur Pollution in Calibrated (Turkey Lake) Watershed.

PRINCIPAL INVESTIGATOR'S NAME: Jerome O. Nriagu

AGENCY AND DEPARTMENT: Environment Canada, National Water Research Institute

ADDRESS: Aquatic Ecology Division
867 Lakeshore Road, P.O. Box 5050
Burlington, Ontario
L7R 4A6

PHONE: (416) 637-4252

COOPERATING AGENCIES AND INVESTIGATORS: Dr. Y.K. Soon

DURATION OF EACH PHASE: Sample acquisition and analysis, 1982-84; Final reports, 1985.

APPROXIMATE COST: 1982/83 - 8K; 1983/84 - 25K; 1984/85 - 10K

OBJECTIVES: Variations in the isotopic ratios can be used to fingerprint the sources and flow of sulfur in a given (Turkey Lake) watershed. The study should lead to a better understanding of the dose/response interactions of pollutant sulfur in a calibrated watershed.

METHOD: Total sulfur concentrations and the isotopic composition of sulfur in atmospheric precipitation at Turkey Lake will be monitored every week. The sulfur levels in the lake water, stream, ground water and suspended particulate samples to be monitored periodically during the year. The flux of sulfur into or out of the sediments to be assessed by determining the forms of sulfur in sediment core samples and the isotopic composition of each sulfur fraction.

ANTICIPATED RESULTS: The following reports are expected:

(a) The role of sediments in the cycling of pollutant sulfur through a watershed.

(b) An isotopic balance for sulfur in the Turkey Lake watershed which will be used to check the mass balance models for this element.

CODE DU SUJET: 3.1.1

NUMÉRO DE PROJET: 159

TITRE: Etude de la fonte printanière au bassin jaugé du lac Laflamme, Forêt Montmorency, Québec

NOM DU CHERCHEUR RESPONSABLE: Jean-Yves Charette

MINISTÈRE, ORGANISME OU ORGANISME PRIVE, SERVICE: Environment Canada
Direction générale des eaux intérieures, région du Québec

ADRESSE: 2700, boul. Laurier
C.P. 10100
Ste-Foy, Québec
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TÉLÉPHONE: (418) 694-3921

COLLABORATEUR(S), ORGANISME(S) ET CHERCHEUR(S): Gilles Robitaille
Environnement Canada
Service canadien des forêts

DURÉE DE CHAQUE PHASE:
mars-juin 82 échantillonnage
juin-décembre 82 interprétation des données
mars-juin 83 échantillonnage
juin-décembre 83 interprétation des données
Réalisation conditionnelle aux résultats de 1982 et aux ressources disponibles.

COÛT APPROXIMATIF: mars - décembre 1982: $1 K

OBJECTIFS DE TRAVAIL: Evaluer l'influence des principales composantes hydrologiques sur la qualité de l'eau de surface du bassin du lac Laflamme durant la fonte printanière.

MÉTHODE DE TRAVAIL: Mesures quantitatives et qualitatives des précipitations, de l'eau de fonte, de l'eau du tributaire principal et de l'exutoire. Mesure des niveaux, piézomètres, analyse de l'eau souterraine et échantillonnage stratifié de l'eau du lac.

RÉSULTATS PRÉVUS: Détermination qualitative et partiellement quantitative de l'influence du couvert forestier, du couvert de neige, du sol et de l'eau souterraine sur la qualité de l'eau, du tributaire, de l'exutoire et du lac Laflamme durant la fonte printanière.

NUMERO DE PROJET: 160

CODE DU SUJET: 3.1.1

TITRE: Bilan ionique du lac Laflamme

NOM DU CHERCHEUR RESPONSABLE: Madeleine Papineau

MINISTÈRE, ORGANISME OU ORGANISME PRIVE, SERVICE: Environnement Canada
Direction générale des eaux intérieures, région du Québec

ADRESSE: 2700, boul. Laurier
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Ste-Foy, Québec
G1V 4H5

TÉLÉPHONE: (418) 694-3921

COLLABORATEUR(S), ORGANISME(S) ET CHERCHEUR(S): Environnement Canada
Relevés hydrologiques à Longueuil (Robert Bibeau)
Laboratoire de la qualité (André Germain)

DURÉE DE CHAQUE PHASE: en continu

COÛT APPROXIMATIF: $20,000

OBJECTIFS DE TRAVAIL:
- évaluer l'état chimique du lac
- évaluer le flux chimique entrée-sortie du bassin

MÉTHODE DE TRAVAIL:
- échantillonnage hebdomadaire au centre et à la sortie du lac.
- enregistrement des données hydrométriques en continu.
- données sur les précipitations

RÉSULTATS PRÉVUS: Un rapport est prévu en mars 1983. Les données disponibles ne seront pas complètes et ne permettront pas de compiler un bilan ionique satisfaisant.

CODE DU SUJET: 3.1.1

NUMERO DE PROJET: 161

TITRE: Evaluation de la sensibilité des lacs de tête compris entre la rivière des Outaouais et la rivière Saguenay.

NOM DU CHERCHEUR RESPONSABLE: Bernard Bobée

MINISTÈRE, ORGANISME OU ORGANISME PRIVÉ, SERVICE: Institut national de la recherche scientifique

ADRESSE: 2700, rue Einstein
C.P. 7500
Ste-Foy, Québec
G1V 4C7

TÉLÉPHONE: (418) 657-2539

COLLABORATEUR(S), ORGANISME(S) ET CHERCHEUR(S): Direction générale des eaux intérieures
Raymond Lemieux
Jean-Yves Charette
John Haemmerli

DURÉE DE CHAQUE PHASE: 10/82 à 05/83

COÛT APPROXIMATIF: 10/82 à 03/83: 52K

OBJECTIFS DE TRAVAIL:

- Evaluation et interprétation de la variabilité spatiale de l'acidification
- Comparaison des données obtenues avec celles résultant d'autres études et incidence sur la modélisation et la compréhension des phénomènes

MÉTHODE DE TRAVAIL:

- Incidence des conclusions obtenues sur la rationalisation du réseau d'échantillonnage.

Utilisation de techniques statistiques telles que l'analyse factorielle des correspondances, classification hiérarchique ascendante.

Utilisation d'indices d'acidification.
Modèles physico-chimiques d'acidification.

RÉSULTATS PRÉVUS: Un rapport sera soumis par le consultant au Ministère Environnement Canada (DGEI) en mars 1983.

NUMÉRO DE PROJET: 162

CODE DU SUJET: 3.1.1

TITRE: Effet des émissions de Noranda sur l'acidification des lacs de la région

NOM DU CHERCHEUR RESPONSABLE: Lévis Talbot et Yves Grimard

MINISTÈRE, ORGANISME OU ORGANISME PRIVE, SERVICE: Service de la qualité des eaux
Ministère de l'Environnement du Québec (MENVIQ)

ADRESSE: 2360, chemin Ste-Foy
Ste-Foy, Québec
G1V 4H2

TÉLÉPHONE: (418) 643-4425

COLLABORATEUR(S), ORGANISME(S) ET CHERCHEUR(S): Laboratoires de Québec, MENVIQ

DURÉE DE CHAQUE PHASE:

COÛT APPROXIMATIF:

Activité 1 - février 1982:	1 000$	(MENVIQ)
Activité 2 - mars 1982:	4 000$	(MENVIQ)
Activité 3 - avril 1982:	2 000$	(MENVIQ)
Activité 4 - automne 1982 et hiver 1983	8 000$	(MENVIQ)

OBJECTIFS DE TRAVAIL: Établir, s'il y a lieu, la contribution des émissions des mines Noranda à l'acidification des lacs de la région.

MÉTHODE DE TRAVAIL:

1) Choix de 60 lacs accessibles en hydravion, situés radialement, par rapport à Noranda, jusqu'à 300 km.

2) Prise d'un échantillon intégré (0 - 5m), sous couvert de glace, au centre géométrique de chaque lac.

3) Analyse des ions majeurs, des paramètres physico-chimiques reliés à l'acidification, et de l'aluminium.

4) Traitement et interprétation des résultats.

RÉSULTATS PRÉVUS:

CODE DU SUJET: 3.1.1

NUMÉRO DE PROJET: 163

TITRE: Effet des précipitations acides sur la physico-chimie des lacs de la région de Portneuf.

NOM DU CHERCHEUR RESPONSABLE: Yves Grimard

MINISTÈRE, ORGANISME OU ORGANISME PRIVÉ, SERVICE: Service de la qualité des eaux
Ministère de l'Environnement du Québec (MENVIQ)

ADRESSE: 2360, chemin Ste-Foy
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TÉLÉPHONE: (418) 643-4425

COLLABORATEUR(S), ORGANISME(S) ET CHERCHEUR(S): Laboratoires de Québec, MENVIQ

DURÉE DE CHAQUE PHASE:

COÛT APPROXIMATIF:

Activité 1 - février 1982:	1 000$	(MENVIQ)
Activité 2 - mars 1982:	20 000$	(MENVIQ)
Activité 3 - avril 1982:	3 000$	(MENVIQ)
Activité 4 - automne 1982 et hiver 1983:	10 000$	(MENVIQ)

OBJECTIFS DE TRAVAIL: Déterminer l'ampleur de l'acidification des lacs dans une des zones les plus susceptibles d'être affectées au Québec.

MÉTHODE DE TRAVAIL:

1. Choix de 100 petits lacs de tête.
2. Échantillonnage par hélicoptère. Prise d'un échantillon intégré (0 - 5 m), sous couvert de glace, au centre géométrique de chaque lac.
3. Analyse des ions majeurs, des paramètres physico-chimiques reliés à l'acidification, et de l'aluminium.
4. Traitement et interprétation des résultats.

RÉSULTATS PRÉVUS:

NUMÉRO DE PROJET: 164

CODE DU SUJET: 3.1.1

TITRE: Détermination des zones sensibles à l'acidification

NOM DU CHERCHEUR RESPONSABLE: Yves Grimard

MINISTÈRE, ORGANISME OU ORGANISME PRIVÉ, SERVICE: Service de la qualité des eaux
Ministère de l'Environnement du Québec (MENVIQ)

ADRESSE: 2360, chemin Ste-Foy
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G1V 4H2

TÉLÉPHONE: (418) 643-4425

COLLABORATEUR(S), Organisme(S) ET CHERCHEUR(S): Ministère du Loisir, de la Chasse et de la Pêche (MLCP)

DURÉE DE CHAQUE PHASE:

COÛT APPROXIMATIF: Activité 1 - été 1976 à 1980: coûts imputés à un autre projet. (MLCP)
Activités 2 et 3 - septembre 1980 à janvier 1981: 10 000$ (MENVIQ)

OBJECTIFS DE TRAVAIL: Identifier les zones potentiellement sensibles à l'acidification à l'aide des données existantes.

MÉTHODE DE TRAVAIL:

1. Mesures in situ du pH et de la conductivité dans 1 333 lacs du Québec, par le MLCP ;lors des "Opérations Sauterelle".
2. Traitement des données.
3. Interprétation des résultats.

RÉSULTATS PRÉVUS:

CODE DU SUJET: 3.1.1

NUMÉRO DE PROJET: 165

TITRE: Hydrologie du bassin du lac Laflamme

NOM DU CHERCHEUR RESPONSABLE: André Plamondon

MINISTÈRE, ORGANISME OU ORGANISME PRIVÉ, SERVICE: Université Laval

ADRESSE: Faculté de foresterie et de géodésie
Ste-Foy, Québec
G1K 7P4

TÉLÉPHONE: (418) 656-7120

COLLABORATEUR(S), ORGANISME(S) ET CHERCHEUR(S): Direction générale des eaux intérieures
Madeleine Papineau

DURÉE DE CHAQUE PHASE: Avril 82 à mars 1983
Avril 83 à septembre 1983

COÛT APPROXIMATIF: 04/82 à 03/83: 37K 04/83 à 08/83. 8K

OBJECTIFS DE TRAVAIL: Quantifier les différentes composantes du cycle hydrologique.

MÉTHODE DE TRAVAIL:

- Mesures sur la fonte de la neige
- Interception et capacité de stockage du couvert forestier
- Précipitation sur le bassin
- Evapotranspiration
- Teneur en eau du sol
- Bilan hydrique

RÉSULTATS PRÉVUS: Cinq rapports sectoriels seront soumis par le consultant au ministère Environnement Canada (DGEI) en mars 1983. Deux autre rapports seront soumis en octobre 1983.

NUMÉRO DE PROJET: 166

CODE DU SUJET: 3.1.1

TITRE: Hydrogéologie du bassin du lac Laflamme

NOM DU CHERCHEUR RESPONSABLE: Louis Azzaria et Pierre Gélinas

MINISTÈRE, ORGANISME OU ORGANISME PRIVÉ, SERVICE: Université Laval

ADRESSE: Ste-Foy, Québec G1K 7P4

TÉLÉPHONE: (418) 656-2913 et 656-2411

COLLABORATEUR(S), ORGANISME(S) ET CHERCHEUR(S): Direction générale des eaux intérieures
Madeleine Papineau

DURÉE DE CHAQUE PHASE: 07/83 à 03/83

COÛT APPROXIMATIF: $43,200

OBJECTIFS DE TRAVAIL: Quantifier et qualifier la contribution des eaux souterraines au bilan ionique et hydrique du bassin.

MÉTHODE DE TRAVAIL:

- Mesures de niveau d'eau dans des piézomètres et des mini-piézomètres
- Mesures de conductivité hydraulique
- Etude des zones de recharge (température, localisation)
- Modèles d'écoulement
- Analyses de la qualité de l'eau

RÉSULTATS PRÉVUS: Un rapport final sera soumis par le consultant au ministère Environnement Canada (DGEI) en mars 1983.

SUBJECT CODE: 3.1.1

PROJECT NUMBER: 167

TITLE: Effects of Acidification on Lake and Stream Chemistry and Biology

PRINCIPAL INVESTIGATOR'S NAME: P. Dillon

AGENCY AND DEPARTMENT: Ministry of the Environment

ADDRESS: P.O. Box 213
Rexdale, Ontario
M9W 5L1

PHONE: (416) 248-3058

COOPERATING AGENCIES AND INVESTIGATORS: Dr. H. Harvey
Dept. of Zoology
University of Toronto

DURATION OF EACH PHASE: Ongoing, reports prepared as data warrant.

APPROXIMATE COST: $100K/year

OBJECTIVES: To determine the long-term effects of the input of acids on the chemistry and biology of lakes and streams and the short-term effects of individual events of high loading.

METHOD: The chemistry, phytoplankton, zooplankton, benthos and fisheries of 8 study lakes and of varying alkalinities (20 to 200 eq l^{-}) have been studied since 1976. Intensive studies of several streams (chemistry and periphyton) are undertaken each year during peak runoff.

ANTICIPATED RESULTS: Eventually, some of the cause-effect relationships linking acidic precipitation and metal deposition to changes in the chemistry and biology of lakes will be quantified, so that measurements at a point in time will be useful for predicting the degree of acidification of the water body.

PROJECT NUMBER: 168

SUBJECT CODE: 3.1.1

TITLE: Watershed Mass Balances

PRINCIPAL INVESTIGATOR'S NAME: P. Dillon

AGENCY AND DEPARTMENT: Ministry of the Environment

ADDRESS: P.O. Box 213
Rexdale, Ontario
M9W 5L1

PHONE: (416) 248-3058

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: Ongoing, reports prepared as data warrant.

APPROXIMATE COST: $200K/year

OBJECTIVES: To develop and test models relating the output of substances (major ions, nutrients, metals, acidity, alkalinity) from different watersheds to geology, land use and hydrology.

METHOD: Approximately 30 individual watersheds ($<10km^2$) have been instrumented for continuous hydrologic measurements since 1976. Atmospheric deposition, and stream chemistry are monitored, geology and soil characteristics are under study, and net and gross watershed budgets calculated.

ANTICIPATED RESULTS: A preliminary model relating the inputs of acid and acidifying substances to output of the products of weathering reactions as a function of geology will be completed in 1983.

SUBJECT CODE: 3.1.1

PROJECT NUMBER: 169

TITLE: Lake Mass Balances

PRINCIPAL INVESTIGATOR'S NAME: P. Dillon

AGENCY AND DEPARTMENT: Ministry of the Environment

ADDRESS: P.O. Box 213
Rexdale, Ontario
M9W 5L1

PHONE: (416) 248-3058

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: On-going, reports prepared as data warrant.

APPROXIMATE COST: $200K/year

OBJECTIVES: To develop and test models relating hydrology, morphometry, physical factors and input and output of major ions, nutrients, metals, acidity and alkalinity to the lake chemistry.

METHOD: The major inputs (atmospheric deposition streamflow) to and outflow from 8 lakes have been increased since 1976 with hydrology and precipitation measured continuously. Models developed for these lakes will be tested on 7 additional lakes for which lake and stream chemistry only have been measured.

ANTICIPATED RESULTS: Preliminary models are currently in preparation. If successful, they will allow us to predict the effects of current inputs of the substances measured on lake chemistry.

PROJECT NUMBER: 170

SUBJECT CODE: 3.1.1

TITLE: Acid Rain Sensitivity Survey of Headwater, Second and Third Order Lakes in Labrador

PRINCIPAL INVESTIGATOR'S NAME: W. J. Bruce
D. Scruton

AGENCY AND DEPARTMENT: Fisheries Research Branch, Fisheries and Oceans

ADDRESS: P.O. Box 5667
St. John's, Newfoundland
A1C 5X1

PHONE: (709) 772-2128
-4485

COOPERATING AGENCIES AND INVESTIGATORS: Dobrocky Seatech (Nfld.) Limited

DURATION OF EACH PHASE: Field sampling - summer/fall 1982
Analyses - 1982-83

APPROXIMATE COST: 1981 - $337K (April 1982 - March 1983)

OBJECTIVES:

a) To determine the present chemical status of a representative number of headwater, second and/or third order lakes in geologically sensitive areas of Labrador and determine whether they are presently being impacted by acid rain,
b) To provide a data base (bench mark) of water quality for assessing the influence of acid precipitation in future years.
c) To establish background concentration levels of trace Al and Hg in fish from sensitive Newfoundland lakes.

METHOD:

Approximately 150-175 headwater, second and/or third order lakes in Labrador will be visited once by fixed wing and/or helicopter. The pH, alkalinity (Gran Titration) and conductivity of lake water will be measured in the field while one 1000 ml sample will be taken for laboratory analysis of major ions and another 250 ml sample will be fixed with HNO_3 for laboratory analysis of trace metals.

Approximately 50 samples (stratified by length) of the type species (lake whitefish, longnose sucker) will be collected from eight lakes for age and growth analyses. These 50 fish (flesh portion) from each lake in each of the eight major geological zones will be analyzed for background levels of mercury and aluminum.

Fifteen fish (depending on gillnet catches) from all other lakes will be analyzed for the same parameters.

ANTICIPATED RESULTS:

a) A standard data base for water quality and fish contaminant body burden of Labrador headwater, second and/or third order lakes will be established. Future changes in water quality can be measured against this data base.
b) It is anticipated that water quality, fish body burden, geological and precipitation data will be used in a model (developed as a result of LRTAP activities) to predict the future impacts of acid rain upon freshwater and associated fisheries in the Newfoundland Region.

CODE DU SUJET: 3.1.1

NUMÉRO DE PROJET: 171

TITRE: Modification de la qualité chimique des eaux de précipitation pendant leur séjour au sol (hiver) et par l'interception de la végétation (printemps, été).

NOM DU CHERCHEUR RESPONSABLE: Gérald Jones

MINISTÈRE, ORGANISME OU ORGANISME PRIVÉ, SERVICE: Institut national de la recherche scientifique (INRS-Eau)

ADRESSE: Complexe scientifique
2700, rue Einstein
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Ste-Foy, Québec
G1V 4C7

TÉLÉPHONE: (418) 657-2533

COLLABORATEUR(S), ORGANISME(S) ET CHERCHEUR(S): Jean-Christian Auclair (INRS-Eau)
Marcel Ouellet (INRS-Eau)
Robert Massé (INRS-Santé)

DURÉE DE CHAQUE PHASE: juin 1983 - juin 1984
juin 1984 - juin 1985
juin 1985 - juin 1986

COÛT APPROXIMATIF: $60,000

OBJECTIFS DE TRAVAIL: Evaluer a) la modification de la qualité des champs de neige en hiver et les mécanismes responsables de la qualité des eaux de fonte printanière; b) la modification de la qualité des eaux de lessivage de la voûte forestière pendant les événements de pluie.

MÉTHODE DE TRAVAIL: Etude de terrain (lac Laflamme 1983) sur des bancs de neige marqués aux étalons des polluants atmosphériques et les observations subséquentes sur la qualité des eaux de percolation et de fonte.
Etude de laboratoire de la fonte contrôlée dans des colonnes de neige homogènes et hétérogènes.
Etude de terrain (lac Tantaré 1983) sur la modification de la pluie par le lessivage de feuilles de bouleaux jaunes.
Etude de terrain sous des conditions modifiées de l'exposition des feuilles à la précipitation.

RÉSULTATS PRÉVUS: Rapport sur i) les relations entre les conditions météorologiques, la qualité de neige et la qualité des eaux de fonte; ii) le taux de lessivage des éléments nutritifs et de matière organique des arbres par les précipitations sous l'action de divers événements météorologiques.

NUMÉRO DE PROJET: 172

CODE DU SUJET: 3.1.1

TITRE: Chimie des eaux atmosphériques

NOM DU CHERCHEUR RESPONSABLE: Gérald Jones

MINISTÈRE, ORGANISME OU ORGANISME PRIVÉ, SERVICE: Institut national de la recherche scientifique (INRS-Eau)

ADRESSE: Complexe scientifique
2700, rue Einstein
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G1V 4C7

TÉLÉPHONE: (418) 657-2533

COLLABORATEUR(S), ORGANISME(S) ET CHERCHEUR(S): Marcel Ouellet (INRS-EAU)
Robert Massé (INRS-Santé)

DURÉE DE CHAQUE PHASE: septembre 1983 - septembre 1984
septembre 1984 - septembre 1985
septembre 1985 - septembre 1986

COÛT APPROXIMATIF: $100,000

OBJECTIFS DE TRAVAIL: Déterminer i) l'origine et la quantité totale de quelques polluants atmosphériques d'origine de combustion des carburants fossiles représentant trois genres d'agents toxiques: les aérosols acides (SO_4, NO_3), les métaux lourds (Pb, Zn) et les hydrocarbures polyaromatiques (HPA); ii) la structure et les modes d'association entre les HPA et les aérosols acides et/ou les métaux lourds.

MÉTHODE DE TRAVAIL: Sites d'échantillonnage: Montréal, Québec, Saguenay - Lac Saint-Jean

Analyse des échantillons de neige et de pluie.

RÉSULTATS PRÉVUS: Rapport sur i) les bilans annuels des dépositions par voie de précipitation des composants polluants et toxiques (aérosols acides, métaux lourds, hydrocarbures polyaromatiques) dans les régions urbaines, rurales et isolées de la provinde de Québec; ii) les associations métaux lourds - aérosols acides et métaux lourds - hydrocarbures polyaromatiques dans les eaux de précipitation.

SUBJECT CODE: 3.1.1

PROJECT NUMBER: 173

TITLE: Effects of Lake Acidification on Rates of Mercury Methylation

PRINCIPAL INVESTIGATOR'S NAME: John W.M. Rudd

AGENCY AND DEPARTMENT: Department of Fisheries and Oceans

ADDRESS: Freshwater Institute
501 University Crescent
Winnipeg, Manitoba
R3T 2N6

PHONE: (204) 269-7379

COOPERATING AGENCIES AND INVESTIGATORS: P. Ramlal
University of Manitoba

DURATION OF EACH PHASE: April 1, 1981 - March 31, 1986

APPROXIMATE COST: 82/83: 23.5K 83/84: 10K

OBJECTIVES: To determine if the acidification of lakes will affect net rates of methyl mercury production in sediment and periphyton communities.

In addition, the effects of increased HS- concentrations on rates of mercury methylation and demethylation will be assayed.

METHOD: A radiochemical method utilizing ^{203}Hg has been developed to assay mercury methylation rates. A method is being developed which will utilize $^{14}CH_3Hg^+$ to assay rates of mercury demethylation.

These methods will be used on lake sediment samples and on laboratory incubated lake sediments at various pH's to determine pH tolerance and effects on rates of Hg methylation and demethylation.

ANTICIPATED RESULTS: Hg concentrations in fish are thought to increase during early stages of acidification. This may be a consequence of increased rates of mercury methylation at low pH or decreased rates of mercury demethylation. The proposed experiments will determine if methylation and demethylation rates change at reduced pH and whether this is because of changes in rates of overall microbial activity or because of changes in methylation or demethylation rates in particular.

In addition, the effects of increased sulphide concentrations present in acidified lakes on rates of methylation and demethylation will be determined. Our previous work on non-acidified systems indicate that contrary to present understandings, sulphide is not an effective inhibitor of mercury methylation.

PROJECT NUMBER: 174

SUBJECT CODE: 3.1.1

TITLE: Effects of Acid Precipitation on the Mobilization of Toxic Trace Metals from Bogs to Freshwater Fish Habitat

PRINCIPAL INVESTIGATOR'S NAME: Dr. R. Newbury

AGENCY AND DEPARTMENT: Department of Fisheries & Oceans

ADDRESS: Freshwater Institute
501 University Crescent
Winnipeg, Manitoba
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PHONE: (204) 269-7379

COOPERATING AGENCIES AND INVESTIGATORS: Dr. S. Bayley
Department of Botany
University of Manitoba

DURATION OF EACH PHASE: 5 years total duration

APPROXIMATE COST: $55,000

OBJECTIVES:
1) To study the effects of acidification on the annual mass balance of several toxic trace metals and other elements known to be affected by acid deposition (N, S, Ca, Fe, etc.)
2) To determine the effects of acidification on the peat substrate bog vegetation and loss of elements from the bog to downstream waters.

METHOD: Chemical analyses of inflow, outflow and bog waters determined weekly during the ice free season. Pore water chemistry is determined using pore water peepers. The bog will be artificially irrigated with water acidified to simulate precipitation in more polluted areas of eastern Canada. Results will be compared with control sites.

ANTICIPATED RESULTS: Guidelines for management on:
1) Yields of acidifying substances and toxic metals from acidified wetlands to aquatic habitats.
2) Effects of acid precipitation on bog vegetation.

SUBJECT CODE: 3.1.1

PROJECT NUMBER: 175

TITLE: Stable Isotopes of Sulfur and Nitrogen as Tracers in Experimental Lake Acidification and as Indicators of Industrial Acidification of Lakes

PRINCIPAL INVESTIGATOR'S NAME: Dr. Raymond H. Hesslein

AGENCY AND DEPARTMENT: Department of Fisheries & Oceans

ADDRESS: Freshwater Institute
501 University Crescent
Winnipeg, Manitoba
R3T 2N6

PHONE: (204) 269-7379

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: 6 years

APPROXIMATE COST: $20,000

OBJECTIVES: 1) To trace the pathways and reactions of added sulphur and nitrogen (having significantly different isotopic ratios than natural S & N) in Lakes 223, 114, 302 in the Experimental Lakes Area.
2) To establish the pattern of isotopic abundances of sulphur and nitrogen in lakes unaffected by acid precipitation. Water, suspended matter and sediments will be studied.
3) Using the understanding gained in 1 and 2, to establish stable isotope methods for establishing the historic acidification or onset of acidification of lakes in impacted areas.

METHOD: High resolution gas source mass spectrometry will be used to determine the isotopic ratios of sulphur and nitrogen. Samples will be taken from water, suspended particulate and sediments. Fractions will be collected from these samples, such as SO_4, H_2S, organic sulfur from water, and acid volatile sulphur, pyrite, elemental sulphur and organic sulphur from sediments. Methods for most of the extractions have been developed by workers in this field and many were tested by R. Cook in a Ph.D. thesis finished last year at ELA. Nitrogen will be approached in a similar fashion. Sulphuric acid presently being used in Lake 223 has a 34/32 signal of +17% vs Canyon Diabolo as compared to natural lake sulphur of +3-5%. This difference is large enough to use without changing the isotopic composition of the acid. The composition of the Nitric Acid is not yet known but $^{15}N\text{-}NO_3$ will be added if necessary to make the signal sufficiently large.

ANTICIPATED RESULTS: We expect to learn how to interpret the sulphur and nitrogen isotope ratios in both acidified and controlled lakes by isotope budgets and rates of change and comparison to chemically and microbiologically measured rates by other ELA workers. We expect to be able to quantify rates of pyrite formation and denitrification in the whole lake. Both of these processes lead to permanent removal of acidity.

We expect to develop, using the sedimentary isotope records and radioisotope dating (^{210}Pb), a means of detecting the impact of industrial source sulphur and nitrogen in lakes in impacted areas. Sulphur of industrial source has a definite isotopic "finger print" as has been shown by Krause (1977) for fossil fuels and Nriagu and Coker (1978) for mineral or sulphur. We believe the sediment record will show the onset and extent of the influence of these sources.

PROJECT NUMBER: 176

SUBJECT CODE: 3.1.1

TITLE: Monitoring of Nutrients and Chemical Constituents in Lake Wabumun

PRINCIPAL INVESTIGATOR'S NAME: P.A. Mitchell

AGENCY AND DEPARTMENT: Water Quality Control Branch, Pollution Control Division, Alberta Environment

ADDRESS: 6th Floor, Oxbridge Place
9820 - 106 Street
Edmonton, Alberta
T5K 2J6

PHONE: (403) 427-5828

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: April 1980 - March 1983

APPROXIMATE COST: $130,000 (82-83)

OBJECTIVES: The study determines whether eutrophication of Lake Wabumun can be controlled by adjusting nutrient inputs to the lake. Constituents important in assessing acid deposition are also being monitored.

METHOD: Contact principal investigator for project methodology.

ANTICIPATED RESULTS: Following the completion of the study in March 1983, a report will be made available from the Pollution Control Division, Alberta Environment.

SUBJECT CODE: 3.1.1

PROJECT NUMBER: 177

TITLE: Aquatic Sensitivity Mapping

PRINCIPAL INVESTIGATOR'S NAME: Trefor Reynoldson

AGENCY AND DEPARTMENT: Water Quality Control Branch, Pollution Control Division, Alberta Environment

ADDRESS: 6th Floor, Oxbridge Place
9820 - 106 Street
Edmonton, Alberta
T5K 2J6

PHONE: (403) 427-5828

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: Commenced in 1982

APPROXIMATE COST: $10,000 (82-83)

OBJECTIVES: Interfaced with soil sensitivity mapping, a representative sample of natural lakes in PreCambrian Shield and Peace River areas is being mapped of pH, alkalinity, and calcium content. In addition, several lakes will be chosen for time series monitoring over the 1983 water year.

METHOD: Contact principal investigator for project methodology.

ANTICIPATED RESULTS: Initial results will be available in 1984 from the Research Management Division, Alberta Environment.

NUMÉRO DE PROJET: 178

CODE DU SUJET: 3.1.1

TITRE: Effet de l'acidification sur la physico-chimie des lacs à l'échelle du Québec

NOM DU CHERCHEUR RESPONSABLE: Bernard Bobée

MINISTÈRE, ORGANISME OU ORGANISME PRIVÉ, SERVICE: INRS-Eau

ADRESSE: 2700, Einstein
Ste-Foy, Québec
G1P 3W8

TÉLÉPHONE: (418) 657-2539

COLLABORATEUR(S), ORGANISME(S) ET CHERCHEUR(S): Service de la qualité des eaux, ministère de l'Environnement du Québec (MENVIQ)
Ministère du Loisir, de la Chasse et de la Pêche (MLCP)
Service canadien de la faune, Environnement Canada
Laboratoires de Québec, MENVIQ

DURÉE DE CHAQUE PHASE:

COÛT APPROXIMATIF:

Activité 1 - printemps et été 1980:	$20,000 plus des coûts imputés à d'autres projets.	(MLCP) (MENVIQ)
Activité 2 - printemps et été 1980:	$5,000 plus des coûts imputés à d'autres projets.	"
Activité 3 - janvier 1981 à janvier 1982:	$20,500 de subvention à la recherche plus $20,000 salaires.	"

OBJECTIFS DE TRAVAIL: Évaluer l'envergure et l'étendue de l'impact des précipitations acides sur la qualité des eaux lacustres au Québec.

MÉTHODE DE TRAVAIL:

Activité 1 - Échantillonnage de 256 lacs du Québec au cours du printemps et/ou de l'été 1980.

Activité 2 - Analyse des ions majeurs, des paramètres physico-chimiques reliés à l'acidification, et de l'aluminium.

Activité 3 - Traitement et interprétation des résultats.

RÉSULTATS PRÉVUS:

SUBJECT CODE: 3.1.1

PROJECT NUMBER: 179

TITLE: Lake Sampling Program, Northwestern Ontario

PRINCIPAL INVESTIGATOR'S NAME: L.W. Maki

AGENCY AND DEPARTMENT: Ontario Ministry of the Environment, Northwestern Region

ADDRESS: 435 James Street South,
Thunder Bay, Ontario
P7C 5G6

PHONE: (807) 475-1215

COOPERATING AGENCIES AND INVESTIGATORS:

Mr. J. Sutton,
Dr. K.J. Deacon,
Dr. G. W. Ozburn,
Lakehead University (Contractor)
Oliver Road,
Thunder Bay, Ontario
P7B 5E1

PHONE: (807) 345-2121

DURATION OF EACH PHASE: Yearly

APPROXIMATE COST: $162K

OBJECTIVES:
- to compile water chemistry data on Northwestern Ontario lakes generated by APIOS funding from 1979-1982.
- to investigate possible water chemistry/bedrock and soil type relationships, as well as any temporal and geographical trends.
- to continue monitoring two sets of sensitive lakes receiving different atmospheric acidic loadings.

METHOD: Composite water column sampling by float-equipped plane and helicopter, three to five times per year.

ANTICIPATED RESULTS: A final report by April 1983, including a sensitivity listing of approximately 450 lakes across Northwestern Ontario (subject to review by APIOS members before becoming released).

PROJECT NUMBER: 180

SUBJECT CODE: 3.1.1

TITLE: Chemical Monitoring of Acid Rivers

PRINCIPAL INVESTIGATOR'S NAME: Walton D. Watt

AGENCY AND DEPARTMENT: Fisheries & Oceans, Resource Branch

ADDRESS: Freshwater & Anadromous Division
P.O. Box 550,
Halifax, N.S.
B3J 2S7

PHONE: (902) 426-3606

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: Continuing

APPROXIMATE COST: $15,000/year

OBJECTIVES: To monitor chemical changes that have occurred as a result of acidification and to observe new alterations.

METHOD: Field sampling and field pH measurements followed by detailed laboratory analyses.

ANTICIPATED RESULTS:
(1) Data are being entered into NAQUADAT system.
(2) A report will be available in 1981.
(3) Publication in 1983.

SUBJECT CODE: 3.1.1

PROJECT NUMBER: 181

TITLE: Water Quality Monitoring of Lakes in the Greater Sudbury Area

PRINCIPAL INVESTIGATOR'S NAME: W. Keller

AGENCY AND DEPARTMENT: Ontario Ministry of the Environment

ADDRESS: 199 Larch Street
Sudbury, Ontario
P3E 5P9

PHONE: (705) 675-4501

COOPERATING AGENCIES AND INVESTIGATORS: Dr. J. Roger Pitblado, Laurentian University (in Data Analysis phase)

DURATION OF EACH PHASE: Annual Surveys 1981, 1982, 1983

APPROXIMATE COST: approx. 50K/yr.

OBJECTIVES:

- to collect yearly data on 250 lakes within approx. 200 km of the smelting centre to permit comparison with the results of an earlier survey in 1974-76.
- to identify temporal changes in water quality which have occurred due to changes in regional atmospheric deposition.

METHOD: Single midsummer sampling of 250 lakes during 1981, 1982, and 1983.

ANTICIPATED RESULTS: Report summarizing observed changes in water chemistry (Draft in Spring 1984?)

PROJECT NUMBER: 182

SUBJECT CODE: 3.1.1

TITLE: Lake Sensitivity Surveys, Northeastern Ontario

PRINCIPAL INVESTIGATOR'S NAME: W. Keller

AGENCY AND DEPARTMENT: Ontario Ministry of the Environment

ADDRESS: 199 Larch Street
Sudbury, Ontario
P3E 5P9

PHONE: (705) 675-4501

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: annual

APPROXIMATE COST: approx. 50K/yr.

OBJECTIVES:

(1) Document the spatial extent of lake sensitivity in Northeastern Ontario.

(2) Monitor temporal changes, and examine natural variability in key acidification-related parameters in Northeastern Ontario lakes.

METHOD:

(1) Sample approx. 100 new lakes per year for pH, inflection point alkalinity, conductivity.

(2) Sample 30 lakes on a continuing basis (6X per yr.)

ANTICIPATED RESULTS: All data incorporated into the provincial lake sensitivity data base on an annual basis.

SUBJECT CODE: 3.1.1

PROJECT NUMBER: 183

TITLE: The Role of Ground Water in the Hydrology of the Calibrated Watersheds in the APIOS

PRINCIPAL INVESTIGATOR'S NAME: U. Sibul
J. Lye

AGENCY AND DEPARTMENT: Ontario Ministry of the Environment
Water Resources Branch
Hydrology and Monitoring Section

ADDRESS: 135 St. Clair Ave. W.
Toronto, Ontario
M4V 1P5

PHONE: (416) 965-6995

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: Ongoing

APPROXIMATE COST: 135K - 1982

OBJECTIVES:
(a) To determine the amount and the quality of ground water discharged directly to lakes.
(b) To determine the amount and quality of ground water in the lake watersheds.
(c) To determine and apply the applicable methods for streamflow hydrograph separation.
(d) To investigate the possible effects of acidic precipitation on ground-water quality.

METHOD:
(a) Obtain and analyse surface and ground-water samples for the common inorganic parameters, trace metals and CO_2.
(b) Install appropriate observation wells for monitoring pH, conductivity, water levels and general water quality.
(c) Install instrumentation for measuring and estimating direct discharge of ground water to the lakes.

ANTICIPATED RESULTS: Report(s) consistent with above objectives.

PROJECT NUMBER: 184

SUBJECT CODE: 3.1.1

TITLE: Trace Metals in Domestic Supplies Utilizing Low-pH Surface Waters

PRINCIPAL INVESTIGATOR'S NAME: U. Sibul
N. Conroy

AGENCY AND DEPARTMENT: Ontario Ministry of the Environment
Water Resources Branch
Hydrology and Monitoring Section

ADDRESS: 135 St. Clair Avenue West
Toronto, Ontario
M4V 1P5

PHONE: (416) 965-6995

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: 4 months in 1983

APPROXIMATE COST: Approx. 10K (1983)

OBJECTIVES: To determine the amounts of trace metals leached from domestic plumbing systems by low-pH waters derived from lakes in the Sudbury area.

METHOD:

(a) Measurements of field pH and conductivity of waters in lakes and tap waters.

(b) Sampling and analysing water samples for trace metals in unflushed and flushed domestic systems.

ANTICIPATED RESULTS: A report consistent with the objective of the study.

SUBJECT CODE: 3.1.1

PROJECT NUMBER: 185

TITLE: Inventory of the Acidity of Domestic Ground-Water Supplies in Northern Ontario

PRINCIPAL INVESTIGATOR'S NAME: U. Sibul

AGENCY AND DEPARTMENT: Ontario Ministry of the Environment
Water Resources Branch
Hydrology and Monitoring Section

ADDRESS: 135 St Clair Avenue West
Toronto, Ontario
M4V 1P5

PHONE: (416) 965-6995

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: On going

APPROXIMATE COST: Approx. 20K per year

OBJECTIVES: To determine the presence and extent of acidic ground-water supplies used for domestic purposes

METHOD:

(a) Measurement of field pH, conductivity and water temperature.

(b) Sampling of water for lab analysis of inorganic parameters, trace metals and CO_2 content.

(c) Determining the effects of domestic plumbing systems on trace metals content.

ANTICIPATED RESULTS: A detailed report on the possible effects of acidic precipitation on ground-water supplies.

PROJECT NUMBER: 186

SUBJECT CODE: 3.1.1

TITLE: Acid Rain Sensitivity Survey of Potential Atlantic Salmon Enhancement Rivers in Labrador

PRINCIPAL INVESTIGATOR'S NAME: W.J. Bruce
D. Scruton

AGENCY AND DEPARTMENT: Fisheries Research Branch

ADDRESS: Fisheries and Oceans
P.O. Box 5667
St. John's, Newfoundland
A1C 5X1

PHONE: (709) 772-2128
-4485

COOPERATING AGENCIES AND INVESTIGATORS: Consultant

DURATION OF EACH PHASE: April 83 - March 84

APPROXIMATE COST: 100K

OBJECTIVES:
(a) To determine sensitivity of selected Atlantic salmon enhancement rivers in Labrador and determine whether they are presently being impacted by acid rain;
(b) To determine buffering capacity of these river systems for future impacts;
(c) To determine maximum pH depressions during fall rains and spring run-off of selected rivers in most sensitive areas.

METHOD:
(a) Monthly water sampling of eight gauged, Atlantic salmon rivers for pH, major ions and trace metals;
(b) More frequent (bi-monthly) water sampling during the rainy fall period and the spring run-off.

ANTICIPATED RESULTS:
(a) Results will show whether any of the planned enhancement rivers are presently being impacted by acid rain and help salmon resource managers choose the best rivers for Atlantic salmon enhancement;
(b) Establish a benchmark for water quality of these rivers which can be re-examined at some future date to measure changes resulting from acid rain;
(c) Comparing rivers in different geological zones will help determine if bedrock geology is a good indicator of water quality in Newfoundland Region and what effect glacial drift has on water quality.

SUBJECT CODE: 3.1.1

PROJECT NUMBER: 187

TITLE: Alkalinity Titration Curves

PRINCIPAL INVESTIGATOR'S NAME: L.G. Swain

AGENCY AND DEPARTMENT: Ministry of Environment
Aquatic Studies Branch

ADDRESS: 765 Broughton street
Victoria, British Columbia
V8V 1X5

PHONE: (604) 387-6387

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: 04/82 - 04/83

APPROXIMATE COST: 04/82 - 04/83 $15,000

OBJECTIVES:

(1) To obtain alkalinity titration curves at a number of low alkalinity lakes.

(2) Investigations on replication in spatial and temporal variation.

METHOD:

(1) Curves are produced at laboratory for collected samples.

(2) Data points for curves are entered into computer storage system.

(3) Statistical analyses will be carried out.

ANTICIPATED RESULTS: Demonstration that alkalinity titration curves are more beneficial in predicting lake sensitivity than other methods such as simple alkalinity values.

PROJECT NUMBER: 188

SUBJECT CODE: 3.1.1

TITLE: Background Data Collection

PRINCIPAL INVESTIGATOR'S NAME: L.G. Swain

AGENCY AND DEPARTMENT: Ministry of Environment
Aquatic Studies Branch

ADDRESS: 765 Broughton Street
Victoria, British Columbia
V8V 1X4

PHONE: (604) 387-6387

COOPERATING AGENCIES AND INVESTIGATORS: Ministry of Environment Regional Offices
J. Balkwill, Aquatic Studies Branch

DURATION OF EACH PHASE: 04/82 - 04/84

APPROXIMATE COST: 04/82 - 04/83 $35,000 04/83 - 04/84 $55,000

OBJECTIVES: (1) To obtain water chemistry information for lakes in large areas of Province where no data have been collected.

METHOD:

(1) Flying into areas not road accessible.

(2) Regional offices sampling some road accessible lakes.

(3) Coordinating with others going to remote sites.

ANTICIPATED RESULTS: Enough data will have been collected to draw accurate lake sensitivity maps during 1984/85 for all of B.C.

SUBJECT CODE: 3.1.1

PROJECT NUMBER: 189

TITLE: Sulfur Biochemistry Historic Deposition

PRINCIPAL INVESTIGATOR'S NAME: Raymond H. Hesslein

AGENCY AND DEPARTMENT: Freshwater Institute/Fisheries & Oceans

ADDRESS: Freshwater Institute
501 University Crescent
Winnipeg, Manitoba
R3T 2N6

PHONE: (204) 269-7379

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: 04/81 - 03/84

APPROXIMATE COST: $19K

OBJECTIVES:
a) Measurement of sulfur isotopes in control and experimentally acidified lakes.
b) Measurement of sulfur isotopes in dated sediments from lakes of known and unknown sulfur isotope histories.
c) Development of isotope techniques for constructing historic sulfur inputs to lakes.

METHOD:
a) Collection of water and sediment core samples
b) Core dating by ^{137}Cs and ^{210}Pb.
c) Mass spectrometry for sulfur isotopic composition.

ANTICIPATED RESULTS:
a) A more complete understanding of sulfur biochemistry in lakes and isotopic budgets will be gained.
b) We hope to develop the ability to reconstruct sulfur deposition histories for lakes based on their sediment records.

PROJECT NUMBER: 190

SUBJECT CODE: 3.1.1

TITLE: Aluminum Toxicity in Natural Waters

PRINCIPAL INVESTIGATOR'S NAME: Dr. James R. Kramer

AGENCY AND DEPARTMENT: Department of Geology
McMaster University

ADDRESS: Hamilton, Ontario
L8S 4M1

PHONE: (416) 525-9140
Ext. 4514

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE:

APPROXIMATE COST:

OBJECTIVES:

a) Determine Al-species in natural waters

b) Determination of the effect of various organic compuunds on aluminum toxicity to fish (minnows and dace).

c) Define the toxic species of aluminum and the concentration levels for acute toxicity.

METHOD:

a) Determination of the toxicity in a chemostat with simple organic compounds.

b) HPLC with conductivity and UV Detectors.

c) Determination of the species with literature and experimental stability constants.

ANTICIPATED RESULTS: Ascertain acute toxic limits of aluminum in the presence of various organic compounds.

SUBJECT CODE: 3.1.1

PROJECT NUMBER: 191

TITLE: Effects of Forest Management Practices on Forest-Watershed Ecosystem Biogeochemistry

PRINCIPAL INVESTIGATOR'S NAME: M.C. Feller

AGENCY AND DEPARTMENT: Faculty of Forestry,
University of B.C.

ADDRESS: Vancouver, B.C.
V6T 1W5

PHONE: (604) 228-5092

COOPERATING AGENCIES AND INVESTIGATORS: J.P. Kimmins, Faculty of Forestry,
University of B.C.

DURATION OF EACH PHASE: 1970 - indefinite

APPROXIMATE COST: 1970-1979 : $100,000
1980-1982 : 50,0000 (includes technician salaries)

OBJECTIVES:

a) Quantify forest-watershed chemical budgets and the effects of clearcutting, slashburning, and herbicide application on these budgets.

b) Determine the influence of streambed sediment on streamwater chemistry.

METHOD:

a) Precipitation, soil solution, and streamwater samples are collected regularly and analyzed for pH, conductivity, cations, and anions. Different watersheds have been instrumented and two have been treated in 1982 - one sprayed with herbicide and the other clearcut. The clearcut area will be slashburned in 1983. Chemical flux in dissolved and particulate forms in streamwater is monitored.

b) Streambed samples are collected regularly throughout the year and analyzed for chemical composition. Solutions of NO_3 have been added to sediment cores in containers in the field to study NO_3 concentration variation with time.

ANTICIPATED RESULTS:

PROJECT NUMBER: 192

SUBJECT CODE: 3.1.1

TITLE: Impact of Atmospheric Pollutants on Georgian Bay

PRINCIPAL INVESTIGATOR'S NAME: Murray G. Johnson

AGENCY AND DEPARTMENT: Department of Fisheries and Oceans, Great Lakes Fisheries Research Branch

ADDRESS: Box 969,
Owen Sound, Ontario

PHONE: (519) 371-0040

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE:

APPROXIMATE COST: $36.5 K O&M/capital

OBJECTIVES:

i) Describe and compare bays and inshore waters of Georgian Bay - fish, benthos plankton, sediments, etc.

ii) Examine inputs from rivers and precipitation to bays of metals, mineral acids.

iii) Assess impairment of ecosystem quality and obtain trend-in-time information on loadings and responses to metals, mineral acids.

iv) Examine changes historically by analysis of microfossils in cores - chironomids, diatoms, molluscs (if present) in relation to trends in metal.

METHOD:

i) Ongoing examination of sediment chemistry and physical properties, together with benthic macroinvertebrate communities - we shall use principal components analysis and community similarity coefficients, etc. to examine for differences and similarities among the bays examined (e.g. McGregor Bay, Bay Finn, Beaverstone Bay, etc.).

ii) Field work to extend collecting southward to Honey Harbour - fish, crayfish, macrophytes, benthos, sediments, to be carried out in August mainly.

iii) Collection from major streams, especially of the spring freshet, to be made as opportunities are presented.

iv) Helicopter and vehicle sampling of two selected basins to begin development of heavy metal and mineral acid, (and bases) from forested watersheds tributary to Georgian Bay (Kelso to do similar work in Superior basin).

v) Begin examination of cores collected in 1980 for microfossils - chironomids, diatoms and perhaps molluscs.

ANTICIPATED RESULTS:

1980/81: Sediment and benthos survey from Bay of Islands to Beaverstone Bay and northern Georgian Bay. River and bay (by helicopter) sampling in spring freshet.
1981/82: crayfish, mussels, macrophytes and fish communities examined. Stream and bay sampling repeated. Sediments analyzed.
Descriptive phase to end in 1984, with completion of work south of French River. Next phase will involve detailed examination of important problem areas, hopefully in collaboration with OMNR, which could commence in 1983.

SUBJECT CODE: 3.1.1

PROJECT NUMBER: 193

TITLE: Effect of Humic Acid on Aluminum Toxicity

PRINCIPAL INVESTIGATOR'S NAME: Dr. S. Ray

AGENCY AND DEPARTMENT: Department of Fisheries and Oceans

ADDRESS: Biological Station
St. Andrews, N.B.
E0G 2X0

PHONE: (506) 529-8854

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: 1 year

APPROXIMATE COST: 1982/83 $30 K

OBJECTIVES: To determine the effect of humic substances on the toxicity of Aluminum to juvenile Atlantic salmon.

METHOD: Standard toxicity dosing and bioassay procedures will be utilized to test the toxicity of aluminum, in varying concentrations of humic acids, to juvenile Atlantic salmon. Humic-aluminum chemical interactions will also be studied. Complexation of other trace elements, like Cu and Zn, with humic and fulvic acids are known to reduce toxicity of the trace elements. Effects of complexation of aluminum with humic acid have not been extensively studied. These interactions will be studied under varying pH conditions to determine the stability of the complexes and subsequent toxicity to fish. The total Aluminum content will be determined by Atomic Absorption. Extensive survey of the literature will be conducted to determine and devise suitable methods for determining the complexed form.

ANTICIPATED RESULTS: Knowledge of the toxicity of Al to Atlantic salmon, as affected by various concentrations of humic acid.

PROJECT NUMBER: 194

SUBJECT CODE: 3.1.1

TITLE: New Brunswick and Nova Scotia Headwater Lake Survey

PRINCIPAL INVESTIGATOR'S NAME: Drs. R.H. Peterson and S. Ray

AGENCY AND DEPARTMENT: Department of Fisheries and Oceans

ADDRESS: Biological Station
St. Andrews, N.B.
E0G 2X0

PHONE: (506) 529-8854

COOPERATING AGENCIES AND INVESTIGATORS:
-Contractor (as yet undecided)
-GLBL (John Kelso)

DURATION OF EACH PHASE: 3 years

APPROXIMATE COST: 1982/3 $200 K

OBJECTIVES: Establish baseline conditions for water chemistry and fish contaminant levels (Cu, Zn, Pb, Hg, Cd, and several organics) in Maritime lakes.

METHOD: Water chemistry, fish sampling (standard gang of gill nets set overnight), and analyses of fish tissues will be performed by standard procedures (see methods used for Ontario portion of study). One vertical plankton tow and one benthic grab sample will also be done per lake.

ANTICIPATED RESULTS: Baseline water chemistry and fish contaminant levels for about 100 Maritime lakes.

SUBJECT CODE: 3.1.1

PROJECT NUMBER: 195

TITLE: Atlantic Regime Acidification Models And Monitoring

PRINCIPAL INVESTIGATOR'S NAME: M.E. Thompson

AGENCY AND DEPARTMENT: Environment Canada, National Water Research Institute

ADDRESS: Canada Centre For Inland Waters
P.O. Box 5050
Burlington, Ontario
L7R 4A6

PHONE: (416) 637-4513

COOPERATING AGENCIES AND INVESTIGATORS:
IWD Water Quality Branch
Fisheries and Oceans Canada
Provincial Department of Environment

DURATION OF EACH PHASE: Reviewed on an annual basis.

APPROXIMATE COST: 18 K (FY82-83)

OBJECTIVES:
1) Using recent or updated information, develop further verification of the CDR model for low alkalinity waters of Canada.
2) Using rain chemistry data from Sable Island, verify the methodologies presently employed to calculate the sea-salt correction for maritime area waters.
3) In coordination with IWD, Water Quality Branch, implement the LRTAP monitoring program planned during FY 82-83 and complete the plans for areas not completed during the prior year.
4) In cooperation with IWD, WQB, ensure that the NAQUADAT data bases are maintained on an up-to-date basis for LRTAP data.

RELEVANCE:
The CDR Model presently forms the primary basis for relating the sulphate loadings to aquatic regime response. Development of an adequate monitor data base and proven sea-salt correction for verification of this model is critical to specification of loading control measures.

METHOD:

ANTICIPATED RESULTS:
Data collected in the monitor and survey programs during FY 82-83 will permit additional validation of the CDR model. There appears to have been a decrease in SO_4 deposition over much of Canada that will provide opportunity to measure the aquatic regime response as compared to the model estimates.

PROJECT NUMBER: 196

SUBJECT CODE: 3.1.1

TITLE: Geochemical Controls of Aquatic System Responses to Acid Rain

PRINCIPAL INVESTIGATOR'S NAME: Dean S. Jeffries

AGENCY AND DEPARTMENT: Environment Canada, National Water Research Institute

ADDRESS: Environmental Contaminants Division
Canada Centre for Inland Waters
Box 5050,
Burlington, Ontario
L7R 4A6

PHONE: (416) 637-4252

COOPERATING AGENCIES AND INVESTIGATORS: R. Semkin

DURATION OF EACH PHASE: On-going

APPROXIMATE COST: 33 K (FY 82/83)

OBJECTIVES: To develop an understanding of the geochemical response of drainage basins to acid precipitation and atmospheric loading of other contaminants. Focus of the study is on delineating the important factors or processes controlling both short and long term acidification of the basins. This study is relevant to an objective of the LRTAP Steering Committee, e.g. determination of mechanisms controlling aquatic ecosystem response to LRTAP.

METHOD:

1) Assessment of the influence of acidic deposition on the material budgets for the Turkey Lakes Watershed (TLW). Deviations of annual (perhaps seasonal) mass balances away from those expected for a "non-impacted" basin will yield information on the degree and rate of acidification in the long term.
2) Assessment of the factors controlling short term acidification of TLW through investigation of snowpack storage and release of contaminants during melt and the variation in stream and lake pH during spring runoff and after major precipitation events.

ANTICIPATED RESULTS: This project will yield information on the rate of acidification of the moderately sensitive TLW. An assessment of the relative importance of short term acidification events is also expected.

SUBJECT CODE: 3.1.1

PROJECT NUMBER: 197

TITLE: Hydrogeochemical Responses of the Turkey Lakes Watershed to Acid Rain

PRINCIPAL INVESTIGATOR'S NAME: Dean S. Jeffries

AGENCY AND DEPARTMENT: Environment Canada, National Water Research Institute

ADDRESS: Environmental Contaminants Division
Canada Centre for Inland Waters
P.O. Box 5050
Burlington, Ontario
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PHONE: (416) 637-4252

COOPERATING AGENCIES AND INVESTIGATORS:

Great Lakes Forest Research Centre
Great Lakes Fisheries Research Branch
National Hydrology Research Institute
Atmospheric Environment Service
Ontario Ministry of Natural Resources
R. Semkin (Co-investigator)

DURATION OF EACH PHASE: On-going

APPROXIMATE COST: 105 K (FY 82/83)

OBJECTIVES: To quantify the hydrogeochemical response of the Turkey Lakes Watershed (TLW) to acidic precipitation using a mass balance approach. Focus of the study is on determining (a) the "dose-response" relationship for this acid susceptible basin and (b) the geochemical mechanisms controlling the relationship. This study is relevant to an objective of the LRTAP Steering Committee, e.g. determination of mechanisms controlling ecosystem response to LRTAP.

METHOD:

1) Continuing measurement of the hydrological budgets for the sub-basins of the TLW.
2) Continuing quantitative year round measurement of the chemical composition of precipitation, streams, and lakes in the TLW.
3) Calculate appropriate mass budgets for the sub basins.
4) From the budgets, describe the movement of materials through the TLW.
5) Compare the TLW response to others being monitored in North America.

ANTICIPATED RESULTS: In co-ordination with the research from co-operating agencies, this watershed study is expected to quantify the ecosystem effects of atmospheric deposition of acids on a moderately sensitive ecosystem.

PROJECT NUMBER: 198

SUBJECT CODE: 3.1.1

TITLE: Spring pH Fluctuations in the North Branch Oromocto River, New Brunswick

PRINCIPAL INVESTIGATOR'S NAME: W.C. Ayer

AGENCY AND DEPARTMENT: Environmental Services Branch, Environment New Brunswick

ADDRESS: P.O. Box 6000
Fredericton, New Brunswick
E3B 5H1

TELEPHONE: (506) 453-2669

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: Feb. - May, 1982

APPROXIMATE COST: $2000

OBJECTIVES:
- To assess temporal fluctuations in pH and other water quality parameters with respect to spring freshet in the North Branch Oromocto River.

METHOD:
- Preliminary information collected 1982
- Bi-weekly collections
- Analysis for pH, alkalinity, turbidity, Cl^-, NO_x, $SO_4^=$, Ca^{++}, Mg^{++}, Na^+, K^+, TOC, NH_3T, Al^{-x}.

ANTICIPATED RESULTS: Data available after internal review

SUBJECT CODE:
3.1.1

PROJECT NUMBER:
199

TITLE: Monitor pH Mill Water Supply

PRINCIPAL INVESTIGATOR'S NAME: W.F. Kelly

AGENCY AND DEPARTMENT: Bowater Mersey Paper Company Limited

ADDRESS: P.O. Box 1150
Liverpool, Nova Scotia
B0T 1K0

PHONE: (902) 354-3411

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: Year

APPROXIMATE COST: Nil

OBJECTIVES: Monitor pH of raw water (source for mill operation) from a small fresh water lake and stream system to determine long range changes in pH due to acidic precipitation.

METHOD: The pH is measured two to three times per week, without paying any attention to rainfall or other changes in the water supply.

ANTICIPATED RESULTS:

NUMÉRO DE PROJET: 200

CODE DU SUJET: 3.1.1

TITRE: Evaluation de la nature de l'acidification des lacs du sud du Québec et incidences sur un réseau d'acquisition de données.

NOM DU CHERCHEUR RESPONSABLE: Bernard Bobee

MINISTÈRE, ORGANISME OU ORGANISME PRIVÉ, SERVICE: INRS-Eau, Université du Québec

ADRESSE: C.P. 7500,
2700 rue Einstein,
Ste-Foy, Québec,
G1V 4C7

TÉLÉPHONE: (418) 657-2539

COLLABORATEUR(S), ORGANISME(S) ET CHERCHEUR(S): Marius Lachance, André Tessier et Jean-Pierre Fortin
INRS-Eau
Raymond Lemieux, Jean-Yves Charette et John Haemmerli-
DGEI-Q

DURÉE DE CHAQUE PHASE:

a) Interprétation de la variabilité spatiale 82/09 - 82/12
b) Application des modèles chimiques 82/11 - 83/01
c) Incidence sur la rationalisation 83/01 - 83/04

COÛT APPROXIMATIF: 82/10 - 83/04 : $ 52 000

OBJECTIFS DE TRAVAIL:

a) Evaluation et interprétation de la variabilité spatiale des paramètres physico-chimiques reliés au processus d'acidification des eaux lacustres du Québec;
b) Comparaison des données obtenues, compréhension des phénomènes chimiques et applicabilté des modèles chimiques;
c) Incidence des conclusions obtenues sur la rationalisation d'un réseau d'échantillonnage.

MÉTHODE DE TRAVAIL:

a) Déterminer et caractériser des zones homogènes en fonction du niveau de sensibilité à l'acidification; identifier des paramètres physiographiques et géomorphologiques pouvant influencer et expliquer la sensibilité des eaux; détecter les zones affectées ou susceptibles de l'être;
b) Appliquer des modèles physico-chimiques d'acidification et examiner la validité pour la zone d'étude des hypothèses sous-jacentes à ces modèles; comparer les résultats obtenus avec ceux obtenus de l'étude effectuée par l'INRS-Eau pour Environnement Québec;
c) Effectuer des recommandations sur la densité des stations et proposer des méthodes de macrolocalisation des stations; proposer une démarche conduisant à la détermination d'une fréquence d'échantillonnage et au choix des périodes de mesure souhaitables.

RÉSULTATS PRÉVUS:

L'étude permettra de:
- poser un diagnostic plus précis de l'état d'acidification des lacs du sud du Québec;
- fournir des éléments qui serviront à l'implantation d'un futur réseau de surveillance de l'acidification des lacs de l'est du Canada

CODE DU SUJET: 3.1.1

NUMÉRO DE PROJET: 201

TITRE: Réseau de surveillance de l'acidification des lacs du Québec

NOM DU CHERCHEUR RESPONSABLE: Paul Potvin

MINISTÈRE, ORGANISME OU ORGANISME PRIVÉ, SERVICE: Service de la qualité des eaux
Ministère de l'Environnement du Québec (MENVIQ)

ADRESSE: 2360, chemin Ste-Foy
Ste-Foy, Québec
G1V 4H2

TÉLÉPHONE: (418) 643-4425

COLLABORATEUR(S), ORGANISME(S) ET CHERCHEUR(S):

DURÉE DE CHAQUE PHASE:

COÛT APPROXIMATIF: Activités 1 et 2 - hiver 1980
Activités 3, 4 et 5 - saisonnières à partir du printemps 1980 pour les lacs de base (continue à long terme).
- Hiver, printemps et été pour 52 lacs satellites différents à chaque année et qui reviennent aux 3 ans (continue à long terme).

Activité 6 - à venir.

OBJECTIFS DE TRAVAIL: Suivre l'évolution physico-chimique de l'acidification des lacs à l'échelle du Québec.

MÉTHODE DE TRAVAIL:

Activité 1 - Choix de 26 lacs de base.

Activité 2 - Choix de 156 lacs satellites.

Activité 3 - Au point le plus profond des lacs, mesures "in situ" du pH, de la température, de l'oxygène dissous, à différentes profondeurs, ainsi que de la transparence et de la profondeur.

Activité 4 - Prise d'échantillons d'eau en intégrant sur une colonne jusqu'à 1,5 fois la transparence ou jusqu'à 1 m du fond.

Activité 5 - Analyse des ions majeurs, des paramètres reliés à l'acidification et à la productivité, de l'aluminium et des métaux traces.

Activité 6 - Traitment et interprétation des données.

RÉSULTATS PRÉVUS:

NUMÉRO DE PROJET: 202

CODE DU SUJET: 3.1.1

TITRE: Etude sur l'acidification des lacs de la station de Biologie de l'Université de Montréal, Laurentides, Québec

NOM DU CHERCHEUR RESPONSABLE: Bernadette Pinel-Alloul

MINISTÈRE, ORGANISME OU ORGANISME PRIVÉ, SERVICE: Centre de recherches écologiques de Montréal
Université de Montréal

ADRESSE: 5858, Côte des Neiges, Bureau 400
C.P. 6128, Succ. A,
Montréal, Québec
H3C 3J7

TÉLÉPHONE: (514) 343-6190

COLLABORATEUR(S), ORGANISME(S) ET CHERCHEUR(S): Ginette Méthot

DURÉE DE CHAQUE PHASE: juillet-août 1981

COÛT APPROXIMATIF: Contrat de $2000

OBJECTIFS DE TRAVAIL: Vérifier au moyen de la documentation (thèses de maîtrise, travaux pratiques) si le pH des lacs de la Station de Biologie de l'Université de Montréal avait varié significativement au cours des 10 dernières années.

MÉTHODE DE TRAVAIL: Nous avons effectué une compilation sommaire des documents disonibles concernant la physico-chimie des plans d'eau de la Station de Biologie de l'Université de Montréal, et nous avons effectué des tests paramétriques entre les paires d'années sur les valeurs de pH.

RÉSULTATS PRÉVUS: Dans l'ensemble, il a été très difficile de mettre en évidence un processus d'acidification dans les lacs de la station parce que les données de pH relevées de la documentation avaient été prélevées par des méthodes diverses et ne peuvent être considérées comme exactes.

CODE DU SUJET: 3.1.1

NUMÉRO DE PROJET: 203

TITRE: Caractéristiques physico-chimiques et biologiques de 67 lacs à sauvagine de la région de Schefferville, Québec

NOM DU CHERCHEUR RESPONSABLE: Yves Grimard et Paul Potvin

MINISTÈRE, ORGANISME OU ORGANISME PRIVÉ, SERVICE: Service de la qualité des eaux
Ministère de l'Environnement du Québec (MENVIQ)

ADRESSE: 2360, chemin Ste-Foy
Ste-Foy, Québec
G1V 4H2

TÉLÉPHONE: (418) 643-4425

COLLABORATEUR(S), ORGANISME(S) ET CHERCHEUR(S): Service canadien de la faune, Environnement Canada, (SCF)
Laboratoires de Québec, MENVIQ

DURÉE DE CHAQUE PHASE:

COÛT APPROXIMATIF:

Activités 1 et 2 - Début de l'été 1981.			(SCF)
Activité 3 - Fin de l'été 1981:	$2,000	Hélicoptère	(MENVIQ)
Activité 4 - Automne 1981:	$1,000	"	
Activité 5 - Printemps 1982:	$3,000	"	

OBJECTIFS DE TRAVAIL: Caractériser, sur le plan physico-chimique et biologique, les lacs afin de fournir un support pour l'établissement par le Service canadien de la faune des relations entre le niveau d'acidification des lacs et les effets sur les oiseaux lacustres.

MÉTHODE DE TRAVAIL:

Activité 1 - Sélection par le SCF de 67 petits lacs de la région de Schefferville, présentant des niveaux d'acidité différents, et entourés, le plus possible, d'habitats ripicoles propices à la nidification des oiseaux lacustres.

Activité 2 - Étude des oiseaux et de leurs habitats par le SCF. Les lacs ont été décrits sommairement quant à leur morphométrie, leur acidité et leurs plantes aquatiques.

Activité 3 - Prise d'échantillons d'eau en intégrant, sur une colonne jusqu'à 1,5 fois la transparence ou jusqu'à un mètre de fond, au point le plus profond de chaque lac.

Activité 4 - Analyses des ions majeurs, des paramètres reliés à l'acidification et à la productivité, de l'aluminium et des métaux traces.

Activité 5 - Traitement et interprétation des données.

RÉSULTATS PRÉVUS:

NUMÉRO DE PROJET: 204

CODE DU SUJET: 3.1.1

TITRE: Effet des précipitations acides sur la physico-chimie des lacs du parc de La Vérendrye

NOM DU CHERCHEUR RESPONSABLE: Yves Grimard

MINISTÈRE, ORGANISME OU ORGANISME PRIVÉ, SERVICE: Service de la qualité des eaux, Ministère de l'Environnement du Québec (MENVIQ)

ADRESSE: 2360, chemin Ste-Foy
Ste-Foy, Québec
G1V 4H2

TÉLÉPHONE: (418) 643-4425

COLLABORATEUR(S), ORGANISME(S) ET CHERCHEUR(S): Ministère du Loisir, de la Chasse et de la Pêche, région de Hull (MLCP)
Laboratoires de Québec, MENVIQ

DURÉE DE CHAQUE PHASE:

COÛT APPROXIMATIF:

Activité 1 - février 1982	$1,000	(MENVIQ)
Activité 2 - mars 1982	$2,000	"
Activité 3 - avril 1982	$1,000	"
Activité 4 - automne 1982 et hiver 1983	$6,000	"

OBJECTIFS DE TRAVAIL: Déterminer s'il y a eu évolution de l'acidité des lacs du parc de La Vérendrye pour lesquels nous possédons des données historiques. Ces lacs sont situés relativement près des sources et sur un milieu géologique sensible.

MÉTHODE DE TRAVAIL:

Activité 1 - Choix de 20 lacs accessibles en hydravion et pour lesquels nous possédons des données historiques.

Activité 2 - Prise d'un échantillon intégré (0 - 5 m), sous - couvert de glace, au centre géométrique de chaque lac.

Activité 3 - Analyse des ions majeurs, des paramètres physico chimiques reliés à l'acidification, et de l'aluminium.

Activité 4 - Traitement et interprétation des résultats.

RÉSULTATS PRÉVUS:

SUBJECT CODE: 3.1.1

PROJECT NUMBER: 205

TITLE: LRTAP Groundwater Modification in the Turkey Lake Watershed

PRINCIPAL INVESTIGATOR'S NAME: Douglas Craig

AGENCY AND DEPARTMENT: Inland Waters Directorate, National Hydrology Research Institute

ADDRESS: c/o Great Lakes Forest Research Centre
1219 Queen Street East, P.O. Box 490
Sault Ste. Marie, Ontario
P6A 5M7

PHONE: (705) 949-9461

COOPERATING AGENCIES AND INVESTIGATORS: D. J. Bottomley (NHRI)
H. Elliot (NHRI)

DURATION OF EACH PHASE: 1983-84 with annual review

APPROXIMATE COST: 1983-84: $50K

OBJECTIVES:

1. To determine the role of ground water in modifying the effects of acid rain on the hydrologic cycle.
2. To investigate the chemical mechanisms operating in a ground water-silicate terrain system.

METHOD:

1. Installation of piezometers in overburden to determine the position of the water table.
2. Sampling and analysis of ground water seeps and piezometers for cations, anions, Al, trace elements and stable isotopes.
3. Estimation of potential ground water contributions to the surface water system using:
   - stream hydrographic separation
   - comparison of ground water vs. stream water quality
   - seepage meters in lake sediments
4. Analysis of geologic samples for size, mineralogy, chemistry and surface weathering effects.
5. Geophysical survey to aid in bedrock contouring of the basin, and sub-bottom profiling of the lakes.

ANTICIPATED RESULTS: Preliminary evaluation of results are that significant modification of surface water stream chemistries may be the result of sub-surface storm and ground water discharges. Further investigation will be necessary to specifically quantify (ground water - soil) - surface water interaction.

NUMÉRO DE PROJET: 206

CODE DU SUJET: 3.1.2

TITRE: Relevé physico-chimique printanier des eaux de surface et des précipitations dans le secteur amont de la rivière des Escoumins

NOM DU CHERCHEUR RESPONSABLE: Claude Langlois

MINISTÈRE, ORGANISME OU ORGANISME PRIVÉ, SERVICE: Pêches et Océans, Habitat du poisson

ADRESSE: Gare Maritime Champlain
901, Cap Diamant
C.P. 15,500
Québec, Québec
G1K 7Y7

TÉLÉPHONE: (418) 694-3478

COLLABORATEUR(S), ORGANISME(S) ET CHERCHEUR(S): Gilles Shooner, Inc., Québec

DURÉE DE CHAQUE PHASE:
- Echantillonnage entre le 20 mars et le 28 avril 1982,
- Compilation et analyse des résultats de mai à septembre 1982,
- Rapport final le 15 octobre 1982.

COÛT APPROXIMATIF: 1981-1982: $6,000 1982-1983: $26,000

OBJECTIFS DE TRAVAIL:
- Effectuer des relevés journaliers de la physico-chimie des eaux de surface et des précipitations durant la période de dégel,
- Evaluer la sensibilité de la rivière des Escoumins à l'acidification par un échantillonnage continu en période de fonte des neiges,
- Evaluer l'impact prévisible de l'acidification sur les sites de frai du saumon de l'Atlantique (Salmo salar).

MÉTHODE DE TRAVAIL:
- Echantillonnage de 4 sous-bassins situés à proximité du lac Boucher, à la tête de la rivière des Escoumins (c.f. carte),
- Echantillonnage journalier des précipitations sur un site (pH, conductivité, sulfates),
- Echantillonnage journalier des eaux de surface sur les 4 sites (pH, conductivité, alcalinité, sulfates, couleur, turbidité),
- Echantillonnage journalier des eaux de surface sur un seul site pour les paramètres suivants: calcium, magnésium, sodium, potassium, aluminium total et soluble, cuivre total et soluble;
- Compilation et traitement des résultats.

RÉSULTATS PRÉVUS:
- Détermination de la variabilité temporelle de la physico-chimie de la rivière des Escoumins durant la période critique du dégel printanier,
- Détermination de la qualité de l'eau durant la période de fonde des neiges sur les frayères des cours d'eau tributaires de la rivière des Escoumins;
- Evaluation de l'effet des précipitations sur l'évolution temporelle de la physico-chimie des eaux de surface.

SUBJECT CODE: 3.1.2

PROJECT NUMBER: 207

TITLE: Study of Periphyton Communities in Acidified Streams in Nova Scotia

PRINCIPAL INVESTIGATOR'S NAME: Dr. D.J. Wildish

AGENCY AND DEPARTMENT: Department of Fisheries and Oceans

ADDRESS: Biological Station
St. Andrews, N.B.
E0G 2X0

PHONE: (506) 529-8854

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: 3 Years

APPROXIMATE COST: $ 37 K

OBJECTIVES: Determine the influence of stream acidity on periphyton community structure.

METHOD: Five Nova Scotian streams of the same size and character, but with different pH regimes (ranging from 4.5-6.5) have been selected. Aquatic macrophyte, epiphyte, epipelic, and invertebrate communities will be investigated. Sampling will be bi-weekly in spring through fall, monthly in the winter.

Aquatic macrophyte topography in the study areas will be determined.

Epiphytes will be sampled and processed as described by Eminson and Moss (1980), and Moss (1981). Macrophytes will be removed from just under the water surface and retained in tubes to which filtered water and Lugol's iodine are added. These are shaken, and the resultant algal suspension reserved for counting. The section of macrophyte will be dried at 100°C and weighed so that algal counts will be expressed as per unit dry macrophyte weight.

To sample epipelic communities, rocks will be removed from the stream, covered with a plastic sheet with a 0.01 M cut-out over the rock, and the epipelon removed with a stiff brush. Cleaned area is etched after collection to avoid sampling the same area in the future. Glass slides will be used as an artificial substrate in order to compare changes in invasion diversity for each stream.

Invertebrate samples will be collected with a Surber sampler to ascertain density of g in 2 hr in relation to the periphyton community.

ANTICIPATED RESULTS: Understanding of periphyton community structure in streams with differing pH's.

PROJECT NUMBER: 208

SUBJECT CODE: 3.1.2

TITLE: Recent pH Changes In N.E. Quebec Lakes as Evidenced by Subfossil Diatom Analysis

PRINCIPAL INVESTIGATOR'S NAME: H.C. Duthie

AGENCY AND DEPARTMENT: University of Waterloo
Department of Biology

ADDRESS: University of Waterloo
Waterloo, Ontario
N2L 3G1

PHONE: (519) 885-1211

COOPERATING AGENCIES AND INVESTIGATORS: Matamek Research Station
Sept-Iles, Quebec

DURATION OF EACH PHASE: 06/82 - 06/83

APPROXIMATE COST: $8,000

OBJECTIVES: Sediment core dicatom analyses yield information on pH changes.

METHOD:

1) Collect short sediment cores from several lakes.
2) Quantitative estimates of diatom flora.
3) Use of diatom indices and/or multivariate statistics to reconstruct pH changes.

ANTICIPATED RESULTS: pH changes over past 150 years.

SUBJECT CODE: 3.1.2

PROJECT NUMBER: 209

TITLE: Water Quality Data for Gregoire Lake Near Fort McMurray

PRINCIPAL INVESTIGATOR'S NAME: Dr. Mark Akena

AGENCY AND DEPARTMENT: Water Quality Control Branch, Pollution Control Division, Alberta Environment

ADDRESS: 6th Floor, Oxbridge Place
9820 - 106 Street
Edmonton, Alberta
T5K 2J6

PHONE: (403) 427-5828

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: April 1980 - March 1982

APPROXIMATE COST: $15,000 (82-83)

OBJECTIVES: Initiated in 1980, this is an extensive baseline data acquisition study incorporating surveys of microphyte populations and their chemical makeup, benthic populations, hydrological cycles, and acid deposition rates.

METHOD: Contact the principal investigator for project methodology.

ANTICIPATED RESULTS: Initial data is available from the Pollution Control Division, Alberta Environment.

PROJECT NUMBER: 210

SUBJECT CODE: 3.1.2

TITLE: Beaver Watershed Study

PRINCIPAL INVESTIGATOR'S NAME: David Trew

AGENCY AND DEPARTMENT: Water Quality Control Branch, Pollution Control Division, Alberta Environment

ADDRESS: 6th Floor, Oxbridge Place
9820 - 106 Street
Edmonton, Alberta
T5K 2J6

PHONE: (403) 427-5828

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: April 1980 - March 1983

APPROXIMATE COST: $80,000 (82-83)

OBJECTIVES: Initiated in 1980, this "trophic status" study of several lakes in east central Alberta measures constituents important for the assessment of acid deposition. The lakes include: Cold, Marie, May, Borque, Hilda, Ethyl, Tucker, and Moore.

METHOD: Contact principal investigator for project methodology.

ANTICIPATED RESULTS: A report will be available following completion of the study in March 1983 from the Pollution Control Division, Alberta Environment.

SUBJECT CODE: 3.1.2

PROJECT NUMBER: 211

TITLE: Phytoplankton and Zooplankton in Northwestern Ontario Lakes

PRINCIPAL INVESTIGATOR'S NAME: L.W. Maki

AGENCY AND DEPARTMENT: M. O. E., Northwestern Region,

ADDRESS: 435 James Street South
Thunder Bay, Ontario
P7C 5G6

PHONE: (807) 475-1215

COOPERATING AGENCIES AND INVESTIGATORS: Mr. J. Sutton, Dr. K. J. Deacon, Dr. G. W. Ozburn
Lakehead University (Contractor)
Oliver Road
Thunder Bay, Ontario P7B 5E1 (807) 345-2121

DURATION OF EACH PHASE: Yearly

APPROXIMATE COST: $38 K

OBJECTIVES:

- To compile data on phytoplankton and zooplankton collected from selected Northwestern Ontario lakes from 1979 - 1981.
- To undertake a joint study of zooplankton/water chemistry relationships with Mr. W. Keller of M. O. E. Northeastern Region.
- To continue collecting phytoplankton and zooplankton from selected lakes.
- To investigate Chaoborous spp. as biological indicators of lake sensitivities, and their relationships to selected chemical parameters.

METHODS: phytoplankton - 3 times per year, composite samples are collected through to a depth of 2.5 times the Secchi disc reading.
zooplankton - 3 times per year, at major lake basins, single vertical hauls from 1 m above bottom are obtained using a 80 micron mesh, 20 cm diameter opening, tow net.

ANTICIPATED RESULTS: A final report by April, 1983, including findings to date is anticipated. Subject to review by APIOS members before being released.

NUMÉRO DE PROJET: 212

CODE DU SUJET: 3.1.2

TITRE: Indice paléo-biologique d'acidification des eaux lacustres

NOM DU CHERCHEUR RESPONSABLE: Marcel Ouellet

MINISTÈRE, ORGANISME OU ORGANISME PRIVÉ, SERVICE: INRS-Eau
Université du Québec

ADRESSE: C.P. 7500
Ste-Foy, Québec
G1V 4C7

TÉLÉPHONE: (418) 657-2555

COLLABORATEUR(S), ORGANISME(S) ET CHERCHEUR(S): Dr. Mike Dickman,
Brock University,
St Catharines (Ontario)
L2S 3A1

DURÉE DE CHAQUE PHASE:

a) échantillonnage : été 1982
b) analyses : hiver 1982
c) compilation : printemps 1983

COÛT APPROXIMATIF: 1982 : $5 000 1983 : $2 000

OBJECTIFS DE TRAVAIL: L'analyse stratigraphique des Diatomées de plusieurs carottes courtes de sédiments lacustres du Québec et de l'Ontario nous permet d'établir, en fonction de l'abondance relative d'espèce sensible, une progression de l'acidification des eaux.

MÉTHODE DE TRAVAIL:

a) utilisation de la méthode stratigraphique;
b) établissement de la chrono-stratigraphie au moyen du ^{137}Cs,
c) utilisation des espèces indicatrices de différents degrés d'alcalinité ou d'acidité selon l'indice de Nygaar.

RÉSULTATS PRÉVUS: Changement en fonction du temps de l'indice de Nygaar pour les lacs acidifiés et stabilité de cet indice pour les lacs non-acidifiés.

SUBJECT CODE: 3.1.2

PROJECT NUMBER: 213

TITLE: Response of Diatom Assemblages in Nova Scotia Lakes to Acidic Depositions

PRINCIPAL INVESTIGATOR'S NAME: Hague H. Vaughan, (Dr.)

AGENCY AND DEPARTMENT: Nova Scotia Department of the Environment, Assessment

ADDRESS: P.O. Box 2107,
Halifax, Nova Scotia
B3J 3B7

PHONE: (902) 424-5300

COOPERATING AGENCIES AND INVESTIGATORS: J.K. Underwood, Nova Scotia Department of the Environment

DURATION OF EACH PHASE: 6/81 - 3/83

APPROXIMATE COST: 3/82-3/83 - $2,000 (excluding salaries)

OBJECTIVES: To determine how selected, small, headwater lakes of presently different chemical characteristics have responded to acidic depositions in the recent past.

METHOD: Emphasizing clear vs. brown water lakes, sediments from the near surface are collected and analyzed for diatom remains. The results are treated according to species specific pH preferences so that comparison of surface and near-surface horizons provides evidence of the magnitude of aquatic responses to acidic deposition.

ANTICIPATED RESULTS:

- Insights into the impacts of LRTAP in comparison to natural sources of acidity.
- Insights into the effects of local sources (e.g Halifax) by comparison with rural lakes.
- Calibration of an Index of acidification appropriate to the particular characteristics of N.S. surface waters.
- Initial work published in Water, Air, Soil Pollution 18(1-3); 1982.

PROJECT NUMBER: 214

SUBJECT CODE: 3.1.2

TITLE: Effects of Acidification on Aquatic Vegetation and Benthic Invertebrates in Ten Southern New Brunswick Lakes

PRINCIPAL INVESTIGATOR'S NAME: A.J. Spavold

AGENCY AND DEPARTMENT: Environmental Services Branch, Environment New Brunswick

ADDRESS: P.O. Box 6000,
Fredericton, N.B.
E3B 5H1

PHONE: (506) 453-2669

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: Phase I - 07-08, 1980
Phase II - 1981-1983
Phase III - 06-09, 1986

APPROXIMATE COST: 1982 - $2,000

OBJECTIVES:
- To describe the population structure of aquatic macrophytes, phytoplankton and benthic invertebrates in 10 New Brunswick Lakes;
- To describe trends in water quality and assess the impact of change on the aquatic flora and invertebrates.

METHOD:
- 1982 - identification and quantitative description of phytoplankton populations.

ANTICIPATED RESULTS: Reports to be issued after internal review

SUBJECT CODE: 3.1.2

PROJECT NUMBER: 215

TITLE: Odour Production by Planktonic Algae in Softwater and Acidic Lakes

PRINCIPAL INVESTIGATOR'S NAME: K. H. Nicholls

AGENCY AND DEPARTMENT: Ontario Ministry of the Environment

ADDRESS: Limnology Section, Ont. Min. Environment
P.O. Box 213
Rexdale, Ontario
M9W 5L1

PHONE: (416) 248-3058

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: 5 years

APPROXIMATE COST: $33,000/year

OBJECTIVES: To determine factors controlling growth and odour production by Chrysochromulina, Synura and Uroglena species in softwater and acidic lakes.

METHOD: 1) Ecological-multivariate analyses
- 12-15 lakes in Sudbury, Muskoka, Haliburton region, measurement of physical-chemical factors.

2) Laboratory
- establish cultures, measure effects of altered conditions.

ANTICIPATED RESULTS: What is the relative importance of pH, alkalinity and other factors in the development of odour producing algae.

PROJECT NUMBER: 216

SUBJECT CODE: 3.1.2

TITLE: Mass Development of Filamentous Algae in Acidic Lakes

PRINCIPAL INVESTIGATOR'S NAME: K. H. Nicholls

AGENCY AND DEPARTMENT: Ontario Ministry of the Environment

ADDRESS: Limnology Section, Ont. Min. Environment
P.O. Box 213
Rexdale, Ontario
M9W 5L1

PHONE: (416) 248-3058

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: 5 years

APPROXIMATE COST:

OBJECTIVES: To determine the causes and consequences of massive development of filamentous algae in acidic lakes.

METHOD: 1) trend with time - long term monitoring of 8 - 10 lakes with wholelake nearshore mapping of all major filamentous algal growth patterns (May - Sept.) + measurement of several environmental variables.

2) field and laboratory experiments to investigate causes, mechanisms and consequences of increased biomass of filamentous algae.

ANTICIPATED RESULTS: Will determine the role of acid deposition on filamentous algal growth.

SUBJECT CODE: 3.1.2

PROJECT NUMBER: 217

TITLE: Rates of Change of Lake pH determined from Algal "Fossils" in Lake Sediment

PRINCIPAL INVESTIGATOR'S NAME: K. H. Nicholls

AGENCY AND DEPARTMENT: Ontario Ministry of the Environment

ADDRESS: Limnology Section, Ont. Min. Environment
P.O. Box 213
Rexdale, Ontario
M9W 5L1

PHONE: (416) 248-3058

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: 5 years

APPROXIMATE COST: $20K/year

OBJECTIVES: To determine the rate of change of pH in selected lakes in Muskoka-Haliburton.

METHOD: Establish diatom taxonomy data base from surface sediments of 20 reference lakes with pH 5.0 - 7.5. Relate by multivariate methods associations of species to ranges of lake water pH. Employ these data in analysis of dated sediment cores (^{210}Pb methodology) selected lakes to determine rate of change of species associations = pH.

ANTICIPATED RESULTS: Determination of rate of change of lake pH.

PROJECT NUMBER: 218

SUBJECT CODE: 3.1.3

TITLE: Zooplankton Community Assessment in Three Lakes

PRINCIPAL INVESTIGATOR'S NAME: J.J. Kerekes

AGENCY AND DEPARTMENT: Environment Canada, Canadian Wildlife Service, Atlantic Region

ADDRESS: c/o Biology Department
Dalhousie University
Halifax, Nova Scotia
B3H 4J1

PHONE: (902) 426-6356

COOPERATING AGENCIES AND INVESTIGATORS: Dr. P. Lane
Biology Department
Dalhousie University
Halifax, Nova Scotia

DURATION OF EACH PHASE: 1980, 1981 baseline characterization
1982, 1983 in situ dose/response experiments
1984, final reporting

APPROXIMATE COST: 1983 - 1984 15K

OBJECTIVES: Identify and describe zooplankton populations, estimate their abundance and productivity in the three study lakes. Determine the response of zooplankton populations to controlled experimental acidification and liming using eight in-situ enclosures in Beaverskin Lake.

METHOD: Quantitative samples of zooplankton are to be taken in each of three study lakes, once a month throughout the year in 1980 and 1981, both at central and inshore stations and at a number of intervals and depths. Also, bottom samples will be taken with a dredge to assess mesoplanktonic populations and how extensively the mud-water interface is used as a habitat. Sampling is done in conjunction with regular limnological sampling, described separately. In 1982 and 1983 eight experimental enclosures, acidified limed, enriched with nutrients and controls (two each) will be sampled every 10 days for three months in Beaverskin Lake.

ANTICIPATED RESULTS: Baseline characterization and comparison of three planktonic communities in Kejimkujik National Park (1980-1981).
Report completion date, fall 1982. The response of a zooplankton community to experimental acidification and liming.
Report completion date, 1983.
The zooplankton community in three acid stressed lakes in Nova Scotia.
Papers in 1983 and 1984.
Ph.D. Thesis on the zooplankton of three lakes, by A. Blouin in 1984.

SUBJECT CODE: 3.1.3

PROJECT NUMBER: 219

TITLE: Variations in Physiological Characteristics and in Population Dynamics of Natural Zooplankton Communities Subjected to Elevated Heavy Metal or Metalloid Concentrations in Concert With Manipulated Lake pH Regimes

PRINCIPAL INVESTIGATOR'S NAME: S.G. Lawrence

AGENCY AND DEPARTMENT: Department of Fisheries and Oceans

ADDRESS: Freshwater Institute
501 University Crescent
Winnipeg, Manitoba
R3T 2N6

PHONE: (204) 269-7379

COOPERATING AGENCIES AND INVESTIGATORS:
M.H. Holoka
S.L. Leonhard
M. MacIver

DURATION OF EACH PHASE: 1977 - 1979, 1982 - L223 (ELA, Ontario); 1979 - end of experiment - L302 (ELA); 1982 - L114 (ELA); 1982 - Lakes Hamell, Douglas, Thompson (near Flin Flon, Manitoba)

APPROXIMATE COST: $6,000./year exclusive of salary, contracts, transportation and room and board costs in the Experimental Lakes Area and in Flin Flon.

OBJECTIVES:

a) To subject impounded zooplankton communities or single species to heavy metals (e.g. Zn, Cd) or metalloids (e.g. Al) prior to pH manipulation and establish threshold concentrations which cause significant variations in specific physiological characteristics (e.g. egg production) and community population dynamics.

b) As the pH regime of a given lake or water source is manipulated, to establish whether these threshold concentrations change.

METHOD:

a) Impoundment of natural zooplankton communities in a four unit system incubated in situ through which metered amounts of filtered lake water is pumped and metal added at a constant rate to half the units, with subsequent assessment using standard methods of zooplankton enumeration and measurement.

b) Impoundment of natural zooplankton communities incubated in situ in static multiunit systems to which varying concentrations of metal are added.

c) Laboratory experiments with individual species using bioassay techniques suitable for assessing chronic toxicity.

ANTICIPATED RESULTS:

a) Establishment of zooplankton data base for various lakes in the Canadian Shield.

b) Development of methods for working with zooplankton communities in situ in conjunction with full ecosystem manipulation.

c) Publication of significant data of specialized type, contribution of specific data for publication of material dealing with overall problems of acid precipitation and metal mobilization.

PROJECT NUMBER: 220

SUBJECT CODE: 3.1.3

TITLE: The Community Structure and Dynamics of Zooplankton Prior to and During the Manipulation of the pH of Shield Lakes

PRINCIPAL INVESTIGATOR'S NAME: S.G. Lawrence

AGENCY AND DEPARTMENT: Department of Fisheries & Oceans

ADDRESS: Freshwater Institute
501 University Crescent
Winnipeg, Manitoba
R3T 2N6

PHONE: (204) 269-7379

COOPERATING AGENCIES AND INVESTIGATORS:

M. MacIver
480 Ash Street
Winnipeg, Manitoba

D.W. Schindler
D.F. Malley
Freshwater Institute

DURATION OF EACH PHASE: 1976 - 1980 (L223), 1980 - end of experiment (L114)
1980 - end of experiment (L302)

APPROXIMATE COST: 1976 - 1978: $14,000/year 1979: $15,000
1980 - 1981: $17,000/year 1982 - 1983: $20,000/year Contract
Does not include cost of sampling

OBJECTIVES:

a) To identify the zooplankton community in each lake prior to manipulation and to establish base-line data through a master sampling program.
b) To monitor changes in those communities during long-range manipulation to lower the pH of the lake.

METHOD:

a) Sample lakes at various depths on summer or winter schedule using standard techniques (e.g. closing cylindrical nets).
b) Enumeration and measurement of most rotifers and crustaceans to species and life phase (a few to genus), calculation of biomass.

ANTICIPATED RESULTS: Contributions to the primary literature on the nature of changes in zooplankton communities due to various kinds of manipulation of lake pH.

SUBJECT CODE: 3.1.3

PROJECT NUMBER: 221

TITLE: Impact of Acidification on Zooplankton Communities and on Zooplankton-Phytoplankton Relationships in Precambrian Shield Lakes

PRINCIPAL INVESTIGATOR'S NAME: D.F. Malley

AGENCY AND DEPARTMENT: Department of Fisheries and Oceans

ADDRESS: Freshwater Institute
501 University Crescent
Winnipeg, Manitoba
R3T 2N6

PHONE: (204) 269-7379

COOPERATING AGENCIES AND INVESTIGATORS:
P.S.S. Chang
W.J. Findlay
D.L. Findlay

DURATION OF EACH PHASE: Until March, 1984

APPROXIMATE COST:

OBJECTIVES:
1. To document changes in biomass, fecundity and species composition of zooplankton communities in two lakes, 223 and 302, in the Experimental Lakes Area, subject to several regimes of acid addition.
2. To document changes in relations between phytoplankton and zooplankton communities with acidification.

METHOD:
1. Biweekly sampling of zooplankton from discrete thermal layers of Lakes 223 and 302.
2. Identification and counting of individuals of various species and life stages.
3. Comparisons of a. standing zooplankton and algal biomass, b. size distributions of individuals in the algal and zooplankton communities, c. calculated energy flow from phytoplankton and zooplankton, under non-acidic conditions and at various levels of acidity.

ANTICIPATED RESULTS: Conclusions concerning the impact of acidification on the pelagic food chain at several levels of acidity and in cases where the acidity is the result of addition of two different acids, sulfuric vs. nitric.

NUMÉRO DE PROJET: 222

CODE DU SUJET: 3.1.4

TITRE: Inventaire ichthyologique du lac Laflamme

NOM DU CHERCHEUR RESPONSABLE: Claude Langlois

MINISTÈRE, ORGANISME OU ORGANISME PRIVÉ, SERVICE: Pêches et Océans
Habitat du poisson

ADRESSE: Gare Maritime Champlain
901, Cap Diamant
Case Postale 15,500
Québec, Québec
G1K 7Y7

TÉLÉPHONE: (418) 694-3478

COLLABORATEUR(S), ORGANISME(S) ET CHERCHEUR(S): Environnement-Canada (Québec)

DURÉE DE CHAQUE PHASE:
- Enchantillonnage: (1) Septembre - Octobre 1982;
  (2) Avril - Juin 1983
- Rapport d'étape le 15 décembre 1982;
- Rapport final le 1 septembre 1983

COÛT APPROXIMATIF:
1982 - 1983: $10,000.
1983 - 1984: $12,000.

OBJECTIFS DE TRAVAIL:
- Acquérir des données de base sur les principales caractéristiques de la population de poissons du lac Laflamme,
- Etude de la reproduction et de la fécondité des populations;
- Etude de la dynamique des populations

MÉTHODE DE TRAVAIL:

1) Etude de la fécondité et de la reproduction:
   - localisation des frayères,
   - étude du comportement des géniteurs;
   - dénombrement des géniteurs,
   - identification du substrat des sites de frai;
   - capture de géniteurs et marquage,
   - mesure de la longueur totale et à la fourche;
   - mesure du poids total et des gonades;
   - identification des sexes;
   - évaluation de la maturation des gonades;
   - prélèvement des gonades pour mesure de fécondité;
   - prélèvement des otolithes pour détermination de l'âge;
2) Etude de la dynamique:
   - capture-marquage-recapture;
   - mesures de longueur et de poids,
   - identification des sexes;
   - utilisation de modèles mathématiques (Peterson, Chapman, Bailey, Schnabel) pour le calcul des paramètres suivants: taux de croissance, taux de mortalité, taux de survie, par groupe d'âge, coefficient de condition, type de croissance, structure d'âge de la population.

RÉSULTATS PRÉVUS:
- Evaluation de la diversité spécifique des populations de poissons;
- Estimé quantitatif des populations,
- Etat physiologique des poissons;
- Evaluation du succès de reproduction des poissons.

CODE DU SUJET: 3.1.4

NUMÉRO DE PROJET: 223

TITRE: Etude de l'influence de l'acidification sur la fécondité et la mortalité de l'omble de fontaine (Salvelinus fontinalis).

NOM DU CHERCHEUR RESPONSABLE: Claude Langlois

MINISTÈRE, ORGANISME OU ORGANISME PRIVÉ, SERVICE: Pêches et Océans
Habitat du poisson

ADRESSE: Gare Maritime Champlain
901, Cap Diamant
Case Postale 15,500
Québec, Québec
G1K 7Y7

TÉLÉPHONE: (418) 694-3478

COLLABORATEUR(S), ORGANISME(S) ET CHERCHEUR(S): Bio-Conseil Inc., Québec, Québec
Ministère québécois du Loisir, de la Chasse et de la Pêche, Québec, Québec

DURÉE DE CHAQUE PHASE: 1981 - 1983

COÛT APPROXIMATIF: 1981 - 1982: $30,000.
1982 - 1983: $45,000.

OBJECTIFS DE TRAVAIL:
- Evaluer l'influence des variations temporelles de la physicochimie de l'eau sur les sites de frai et le succès de reproduction de l'omble de fontaine,
- Evaluer la vulnérabilité de l'espèce à différents stades de développement de l'oeuf,
- Déterminer l'effet prévisible de l'acidification sur la baisse des populations d'omble de fontaine.

MÉTHODE DE TRAVAIL: Deux groupes de lacs sont sélectionnés; ils sont similaires à tous les points de vue (géologie, altitude, hydrologie, niveau d'exploitation, pédologie, couvert forestier des rives, etc...), sauf quant à leur niveau d'acidification. Les frayères sont localisées, des géniteurs sont capturés et des oeufs fécondés sont implantés dans des boîtes de Viber sur le site des frayères. La mortalité des oeufs, l'éclosion et la survie des alevins est observée périodiquement entre le moment de l'implantation à l'automne et la fin de la période du dégel au printemps. L'interprétation des résultats est effectuées parallèlement aux observations et en fonction de l'évaluation historique et expérimentale des populations.

RÉSULTATS PRÉVUS:
- Identifier la relation entre l'apport acide et la mortalité des oeufs;
- Identifier la relation entre les retards ou anomalies de développement et de croissance et l'apport acide,
- Identifier la relation entre l'évolution des populations d'omble de fontaine et l'apport acide.

NUMÉRO DE PROJET: 224

CODE DU SUJET: 3.1.4

TITRE: Inventaire périodique des rivières à saumon de la Côte-Nord

NOM DU CHERCHEUR RESPONSABLE: Claude Langlois

MINISTÈRE, ORGANISME OU ORGANISME PRIVÉ, SERVICE: Pêches et Océans
Habitat du poisson

ADRESSE: Gare Maritime Champlain
901, Cap Diamant
Case Postale 15,500
Québec, Québec
G1K 7Y7

TÉLÉPHONE: (418) 694-3478

COLLABORATEUR(S), ORGANISME(S) ET CHERCHEUR(S): Gilles Shooner Inc., Québec, Québec

DURÉE DE CHAQUE PHASE:
Echantillonnage: Août 1982 à Mars 1983,
Analyse des résultats: Mars 1983 à Mai 1983,
Rapport final: Juin 1983,
Rapport préliminaire: (à poursuivre en 1983/1984).

COÛT APPROXIMATIF: 1982 - 1983: $30,000. 1983 - 1984: $18,000.

OBJECTIFS DE TRAVAIL:
- Evaluer la variabilité spatiale et temporelle de la physico-chimie de l'eau dans les rivières échantillonnées,
- Déterminer les périodes critiques au point de vue de la physico-chimie,
- Estimer l'impact de la qualité physico-chimique des rivières pour la survie du saumon de l'Atlantique au Québec,
- Poursuivre l'échantillonnage débuté en 1981-1982 sur 12 rivières de la haute et moyenne Côte-Nord;
- Entreprendre un échantillonnage semblable sur 10 rivières de la basse Côte-Nord.

MÉTHODE DE TRAVAIL:
L'échantillonnage est effectué mensuellement entre août 1982 et mars 1983. Les vingt-deux (22) rivières sont échantillonnées près de l'embouchure. Les paramètres physico-chimiques analysés sont les suivants:
- température, pH et conductivité (sur le terrain),
- alcalinité, nitrates, turbidité, couleur vraie, carbone organique et inorganique total et dissous, chlorures et sulfates (en laboratoire dans un délai de 24 heures);
- Ca, Mg, K, Na, Al, Cd, Cu, Fe, Mn, Ni, Pb et Zn (en laboratoire). Les données physico-chimiques sont confrontées à des données sur les populations de saumons lorsque disponibles.

RÉSULTATS PRÉVUS:
- Identification des rivières les plus affectées par les précipitations acides;
- Evaluation préliminaire des effets de l'acidification sur les populations de saumons;
- Sélection de rivières-cibles pour approfondir la relation entre l'acidification et les populations de poissons.

CODE DU SUJET: 3.1.4

NUMÉRO DE PROJET: 225

TITRE: Ecotoxicologie de l'aluminium chez les salmonides en relation avec les précipitations acides

NOM DU CHERCHEUR RESPONSABLE: Raymond Van Coillie

MINISTÈRE, ORGANISME OU ORGANISME PRIVE, SERVICE: Eco-Recherches Inc. (filiale CIL)

ADRESSE: 121 Boulevard Hymus
Pointe Claire, Québec
H9R 1E6

TÉLÉPHONE: (514) 697-3273

COLLABORATEUR(S), ORGANISME(S) ET CHERCHEUR(S): Thellen, C. (Eco-Recherches Inc.)
Campbell, P. (INRS-Eau: Université du Québec)
Chevalier, G. (UQAM: Université du Québec)
Visser, S. (Université Laval)

DURÉE DE CHAQUE PHASE: Une Phase

COÛT APPROXIMATIF: $8,500 (1982-83)

OBJECTIFS DE TRAVAIL: Préciser les effets de l'aluminium à differents pH et à differentes alcalinités et duretes pour trois espèces de salmonides.

MÉTHODE DE TRAVAIL: Tests de Toxicité le tale.

Tests de toxicité sous-letale: évitement, préférence, respirometrie.

Tests de bioaccumulation.

Tests de biochimie anabolique.

Effets et localisations histologiques spéciation ecotoxicologique aluminium.

RÉSULTATS PRÉVUS: Mecanismes action aluminium relache par précipitations acides.

NUMÉRO DE PROJET: 226

CODE DU SUJET: 3.1.4

TITRE: Relevé physico-chimique printanier des eaux de surface et des précipitations dans le secteur amont de la rivière des Escoumins

NOM DU CHERCHEUR RESPONSABLE: Claude Langlois

MINISTÈRE, ORGANISME OU ORGANISME PRIVÉ, SERVICE: Pêches et Océans, Habitat du poisson

ADRESSE: Gare Maritime Champlain
901, Cap Diamant
Case Postale 15,500
Québec, Québec
G1K 7Y7

TÉLÉPHONE: (418) 694-3478

COLLABORATEUR(S), ORGANISME(S) ET CHERCHEUR(S): Gilles Shooner Inc., Québec

DURÉE DE CHAQUE PHASE:

- Echantillonnage entre le 20 mars et le 28 avril 1982
- Compilation et analyse des résultats de mai à septembre 1982,
- Rapport final le 15 octobre 1982.

COÛT APPROXIMATIF: 1981-1982: $6,000 1982-1983. $26,000

OBJECTIFS DE TRAVAIL:

- Effectuer des relevés journaliers de la physico-chimie des eaux de surface et des précipitations durant la période de dégel,
- Evaluer la sensibilité de la rivière des Escoumins à l'acidifications par un échantillonnage continu en période de fonte des neiges,
- Evaluer l'impact prévisible de l'acidification sur les sites de frai du saumon de l'Atlantique (Salmo salar).

MÉTHODE DE TRAVAIL:

- Echantillonnage de 4 sous-bassins situés à proximité du lac Boucher, à la tête de la rivière des Escoumins (c.f. carte), Echantillonnage journalier des précipitations sur un site (pH, conductivité, sulfates),
- Echantillonnage journalier des eaux de surface sur les 4 sites (pH, conductivité, alcalinité, sulfates, couleur, turbidité),
- Echantillonnage journalier des eaux de surface sur un seul site pour les paramètres suivants: calcium, magnésium, sodium, potassium, aluminium total et soluble, cuivre total et soluble;
- Compilation et traitement des résultats.

RÉSULTATS PRÉVUS:

- Détermination de la variabilité temporelle de la physico-chimie de la rivière des Escoumins durant la période critique du dégel printanier;
- Détermination de la qualité de l'eau durant la période de fonde des eniges sur les frayères des cours d'eau tributaires de la rivière des Escoumins,
- Evaluation de l'effet des précipitations sur l'évolution temporelle de la physico-chimie des eaux de surface.

CODE DU SUJET: 3.1.4

NUMÉRO DE PROJET: 227

TITRE:

NOM DU CHERCHEUR RESPONSABLE: Bernadette Pinel-Alloul

MINISTÈRE, ORGANISME OU ORGANISME PRIVÉ, SERVICE: Université de Montréal, Département de Sciences biologiques

ADRESSE: C.P. 6128, Succ. A
Montréal, Québec
H3C 3J7

TÉLÉPHONE: (514) 343-6792

COLLABORATEUR(S), ORGANISME(S) ET CHERCHEUR(S):

DURÉE DE CHAQUE PHASE: Projet en cours depuis 1981 - finalisation en 1983

COÛT APPROXIMATIF: Subvention thématique CRSNG - $12K/an (1981) (en partie)
Subvention individuelle CRSNG - $10K/an (1982-83) (en partie)

OBJECTIFS DE TRAVAIL: Toxicité spécifique et combinée de 4 métaux lourds (Cu, Zn, Hg et Cd) sur les Crustacés Chydorus sphaericus (Cladocera), Tropocyclops prasinus (Cyclopoïda), Diaptomus oregonensis et Diaptomus leptopus (Calandoïda) de trois lacs du Québec.

MÉTHODE DE TRAVAIL:

1) Toxicité aigüe estimée par épreuves biologiques en conditions statiques.

2) Estimation de la mortalité des crustacés pour 4 métaux lourds (Cu, Cd, Hg, Zn) et de leur mélange par la concentration effective (EC_{50}) pour immobiliser 50% des organismes. La mortalité est exprimée par l'absence de réactions natatoires à un stimulus mécanique.

3) Estimation des courbes de mortalité par la méthode tronquée de Spearman-Karber (Hamilton et al., 1977) ou l'analyse Probit sur les données normalisées.

RÉSULTATS PRÉVUS:

NUMÉRO DE PROJET: 228

CODE DU SUJET: 3.1.4

TITRE: Etablissement des relations conditions-effets par l'acidification et la neutralisation de lacs du parc des Laurentides

NOM DU CHERCHEUR RESPONSABLE: Guy Moreau

MINISTÈRE, ORGANISME OU ORGANISME PRIVÉ, SERVICE: Centre de recherche sur l'eau (CENTREAU)
Université Laval

ADRESSE: Québec, Québec **TÉLÉPHONE:** (418) 656-4023

COLLABORATEUR(S), ORGANISME(S) ET CHERCHEUR(S): Service de la qualité des eaux, ministère de l'Environnement du Québec (MENVIQ)
Direction de la recherche, MENVIQ
Ministère du Loisir, de la Chasse et de la Pêche (MLCP)
Laboratoires de Québec, MENVIQ.

DURÉE DE CHAQUE PHASE et COÛT APPROXIMATIF:

Activité 1 - juin 1982: coût négligeable
Activité 2 - juillet 1982 à août 1983
Activité 3 - printemps 1983
Activités 4, 5 et 6 - étés 1982 et 1983
Activité 7 - été 1982
Activités 8 et 9 - automne et hiver 1982 et automne 1983
Activité 10 - rapport d'étape avant le 1er avril 1983,
rapport final avant le 1er janvier 1984.

* Subvention à CENTREAU: $128K (MENVIQ)
Analyses physico-chimiques: $1K "

OBJECTIFS DE TRAVAIL: Établir les relations entre le niveau d'acidification du milieu aquatique et les effets sur les organismes biologiques, en mettant l'accent sur la détermination du seuil de tolérance pour la survie de l'omble de fontaine et, à l'opposé, le seuil pour lequel tous les effets ont complètement disparu.

MÉTHODE DE TRAVAIL:

1. Choix de quatre lacs.

2. Échantillonnage et analyses physico-chimiques mensuellement durant l'année et hebdomadairement en période de crue à trois stations de chaque lac.

3. Acidification d'un lac et neutralisation d'un autre lac durant la crue printanière. Les deux derniers lacs sont gardés comme témoin.

4. Mesures, en triplicata, de carbone organique, chlorophylle et ATP, à trois stations par lac, six fois en période estivale, avant et après acidification-neutralisation.

5. Mesures, en triplicata, de production primaire et identification de la communauté zooplanctonique, à deux profondeurs d'une station de chaque lac, trois fois en période estivale, avant et après acidification-neutralisation.

CODE DU SUJET:
3.1.4

NUMÉRO DE PROJET:
228 (cont'd)

MÉTHODE DE TRAVAIL:

6. Mesures, en triplicata, de l'évolution des communautés benthiques à partir de la colonisation de substrats artificiels, à trois stations de chaque lac, trois fois en période estivale, avant et après acidificationneutralisation.

7. Capture de 100 ombles de fontaine ou les prises de trois jours de pêche, mesures de longueur, poids, âge, sexe et maturité sexuelle en période estivale, avant et après acidification-neutralisation.

8. Sur 30 spécimens par lac, mesure des concentrations de zinc et de magnésium dans les opercules.

9. Sur 10 spécimens par lac, histologie et teneur en aluminium des branchies, de même que l'identification de leur contenu stomacal.

10. Traitement et interprétation des résultats.

NUMERO DE PROJET: 229

CODE DU SUJET: 3.1.4

TITRE: Effet de l'acidification des lacs sur la faune ichtyologique de la région de Portneuf

NOM DU CHERCHEUR RESPONSABLE: Yvon Richard

MINISTERE, ORGANISME OU ORGANISME PRIVE, SERVICE: Service de la qualité des eaux
Ministère de l'Environnement du Québec (MENVIQ)

ADRESSE: 2360, chemin Ste-Foy
Ste-Foy, Québec
G1V 4H2

TÉLÉPHONE: (418) 643-4425

COLLABORATEUR(S), ORGANISME(S) ET CHERCHEUR(S): Ministère du Loisir, de la Chasse et de la Pêche (MLCP)
Laboratoires de Québec, MENVIQ
Centre de recherche sur l'eau (CENTREAU), université Laval

DURÉE DE CHAQUE PHASE et COUT APPROXIMATIF:

Activités 1 et 2 - avril 1982:	$ 3,500	(MENVIQ)
Activité 3 - mai 1982:	$ 1,000	"
Activité 4 - mai 1982:	$ 500	"
Activité 5 - à compter de juin 1982:	$10,000/année	"
Activités 6 et 9 - Juin 1982:	$18,000	"
Activité 7 - automne 1982 et hiver 1983:	$ 1,500	"
Activité 8 - automne 1982 et hiver 1983:	$ 4,000	"
Activité 10 - automne 1982 et hiver 1983:	$ 2,000	"
Activité 11 - printemps et été 1983:	$15,000	"

OBJECTIFS DE TRAVAIL:
- Évaluer l'impact de l'acidification des lacs de Portneuf sur l'omble de fontaine,
- mettre à la disposition des chercheurs, des données de base leur permettant de greffer, au présent projet, des études complémentaires.

MÉTHODE DE TRAVAIL:

1. Choix de 34 lacs accessibles par véhicule motorisé de type 4 x 4.
2. Prise d'un échantillon intégré (0 - 5 m), sous couvert de glace, au centre géométrique de chaque lac.
3. Analyse des ions majeurs, des paramètres physico-chimiques reliés à l'acidification, et de l'aluminium.
4. Choix d'un sous-échantillon de 14 lacs couvrant la gamme de niveau d'acidification mesuré pour cette région.

Pour chacun des 14 lacs:

5. échantillonnage et analyses physico-chimiques mensuellement durant l'année et hebdomadairement en période de crue;
6. échantillonnage de 100 ombles de fontaine ou les prises de trois jours de pêche, mesures de longueur, poids, âge et sexe, et dénombrement des autres espèces;
7. sur 30 ombles de fontaine, mesure de la composition miné- rale des opercules et teneur en mercure de la chair;
8. sur 10 ombles de fontaine, histologie et teneur en aluminium des branchies, et identification de leur contenu stomacal;
9. recensement des cyprinidés à l'aide de verveux;
10. sur un maximum de 10 spécimens de chacune des autres espèces, effectuer les mêmes mesures que celles effectuées sur l'omble de fontaine, à l'exception de l'identification du contenu stomacal.
11. Traitement et interprétation des résultats.

SUBJECT CODE: 3.1.4

PROJECT NUMBER: 230

TITLE: Mechanisms of Toxic Action of Acid to Fish: Cardio/Vascular/Respiratory and Ionic/Osmotic Regulatory Systems

PRINCIPAL INVESTIGATOR'S NAME: Dr. M. A. Giles

AGENCY AND DEPARTMENT: Department of Fisheries and Oceans

ADDRESS: Freshwater Institute
501 University Crescent
Winnipeg, Manitoba
R3T 2N6

PHONE: (204) 269-7379

COOPERATING AGENCIES AND INVESTIGATORS: Freshwater Institute, Aquatic Toxicology Section
Dr. T. Hara, S. Brown, R. Evans

DURATION OF EACH PHASE: Set-up: 6/80 - 3/81, Operation: 4/81 - 3/84

APPROXIMATE COST: $20K

OBJECTIVES:

a) To determine the actions and interactions of hydrogen ion and carbon dioxide on cardiovascular/respiratory function and blood electrolyte regulation in fish.

b) To interrelate the results of these studies with the results of neuro-endocrinological and histopathological investigations (Hara, Brown & Evans) on the same stocks of fish to provide a comprehensive statement of the mechanisms by which acid adversely influenced basic physiological functions in fish.

METHOD:

1) 6/80 - 3/81
   a) Install a water treatment system capable of providing water of the exceptional quality and chemical definition required by these studies.
   b) Install a water acidification/degassification system to provide water of controlled pH and carbon dioxide/oxygen concentration.
   c) Estimate the acid tolerance of our laboratory fish stocks through conventional bioassay techniques.
   d) Determine the effect of acute acid exposure (pH range 4.25 to 7.4) upon cardiac and respiratory function and blood/urine electrolyte concentrations.
2) 4/81 - 3/82
   a) The effect of chronic exposure to acid upon cardiovascular/respiratory functions and electrolyte regulation of adult fish will be investigated using a variety of approaches from isolated gill preparations to whole fish. Preliminary integration with the neuroendocrinology studies will be made at this point to define primary and secondary modes of action.

ANTICIPATED RESULTS:

a) Experimental results will be prepared for publication in primary scientific journals.

b) Experimental observations and conclusions will be disseminated to other "acidification projects" such as the ELA studies for verification under "field conditions".

NUMÉRO DE PROJET: 231

CODE DU SUJET: 3.1.4

TITRE: Effet de l'acidité des lacs du parc des Laurentides sur la physiologie et la reproduction de la truite mouchetée

NOM DU CHERCHEUR RESPONSABLE: Guy Moreau

MINISTÈRE, ORGANISME OU ORGANISME PRIVÉ, SERVICE: Centre de recherche sur l'eau, (CENTREAU)

ADRESSE: Université Laval
Québec City, Québec

TÉLÉPHONE: (418) 656-4023

COLLABORATEUR(S), ORGANISME(S) ET CHERCHEUR(S): Service de la qualité des eaux, ministère de l'Environnement du Québec (MENVIQ)
Direction de la recherche, (MENVIQ)
Ministère du Loisir, de la Chasse et de la Pêche (MLCP)
Laboratoires de Québec, MENVIQ

DURÉE DE CHAQUE PHASE:
Activité 1 - été 1981
Activité 2 - automne 1981
Activité 3 - hiver 1981
Activité 4 - octobre 1981 à mai 1982
Activité 5 - juin 1982
Activité 6 - septembre 1981 à août 1982

COÛT APPROXIMATIF: Subvention à Centreau - $110K (MENVIQ)
Expertise et support technique - $10K (MENVIQ)

OBJECTIFS DE TRAVAIL: Déterminer l'effet des précipitations acides sur la faune ichtyenne du parc des Laurentides, en mettant l'accent sur la reproduction, le recrutement et la physiologie de la truite mouchetée.

MÉTHODE DE TRAVAIL:

ACTIVITÉS

1. Choix de six lacs dont trois acides et trois moins acides, parmi les 158 échantillonnés en mars et avril 1981.
2. Cueillette de 30 mâles et 30 femelles sur les frayères. Mesure des paramètres suivants: âge, taille, poids, coefficient de condition, rapport gonadosomatique, nombre et diamètre des oeufs.
3. Sur dix mâles et dix femelles, mesures suivantes: histologie, contenu en eau, en protéines et en lipides des gonades, histologie et teneur en aluminium des branchies, composition minérale des opercules, teneur en métaux lourds des chairs.
4. Prélèvement, fertilisation et incubation en boîte de Vibert, d'oeufs dans les lacs et des rigoles expérimentales à pH contrôlé.
5. Détermination de la structure de la population.
6. Échantillonnage d'eau mensuellement, analyses physico-chimiques des ions majeurs, des paramètres reliés à l'acidification et de l'aluminium.

RÉSULTATS PRÉVUS:

CODE DU SUJET: 3.1.4

NUMÉRO DE PROJET: 232

TITRE: Etude de l'influence de l'acidification sur la fécondité et la mortalité de l'omble de fontaine (Salvelinus fontinalis)

NOM DU CHERCHEUR RESPONSABLE: Claude Langlois

MINISTÈRE, ORGANISME OU ORGANISME PRIVÉ, SERVICE: Pêches et Océans, Habitat du poisson

ADRESSE: Gare Maritime Champlain
901, Cap Diamant
C.P. 15,500
Québec, Québec
G1K 7Y7

TÉLÉPHONE: (418) 694-3478

COLLABORATEUR(S), ORGANISME(S) ET CHERCHEUR(S): Bio-Conseil Inc.
Québec, Québec
Ministère québécois du Loisir, de la Chasse et de la Pêche
Québec, Québec

DURÉE DE CHAQUE PHASE: 1981-83

COÛT APPROXIMATIF: 1981-1982: $30K 1982-83. $45K

OBJECTIFS DE TRAVAIL:
- Evaluer l'influence des variations temporelles de la physico-chimie de l'eau sur les sites de frai et le succès de reproduction de l'omble de fontaine,
- Evaluer la vulnérabilité de l'espèce à différents stades de développement de l'oeuf,
- Déterminer l'effet prévisible de l'acidification sur la baisse des populations d'omble de fontaine.

MÉTHODE DE TRAVAIL: Deux groupes de lacs sont sélectionnés; ils sont similaires à tous les points de vue (géologie, altitude, hydrologie, niveau d'exploitation, pédologie, couvert forestier des rives, etc...), sauf quant à leur niveau d'acidification. Les frayères sont localisées, des géniteurs sont capturés et des oeufs fécondés sont implantés dans des boîtes de Viber sur le site des frayères. La mortalité des oeufs, l'éclosion et la survie des alevins est observée périodiquement entre le moment de l'implantation à l'automne et la fin de la période du dégel au printemps. L'interprétation des résultats est effectuée en considérant les analyses physico-chimiques effectuées parallèlement aux observations et en fonction de l'évaluation historique et expérimentale des populations.

RÉSULTATS PRÉVUS:
- Identifier la relation entre l'apport acide et la mortalité des oeufs;
- Identifier la relation entre les retards ou anomalies de développement et de croissance et l'apport acide,
- Identifier la relation entre l'évolution des populations d'omble de fontaine et l'apport acide.

PROJECT NUMBER: 233

SUBJECT CODE: 3.1.4

TITLE: Effects of Acid Waters on Locomotor Responses of Freshwater Fishes and Invertebrates

PRINCIPAL INVESTIGATOR'S NAME: Dr. E. Scherer

AGENCY AND DEPARTMENT: Department of Fisheries & Oceans

ADDRESS: Freshwater Institute
501 University Crescent
Winnipeg, Manitoba
R3T 2N6

PHONE: (204) 269-7379

COOPERATING AGENCIES AND INVESTIGATORS:
Department of Fisheries & Oceans
Dr. D. W. Schindler
Dr. M. Giles
Dr. K. Jones (contract)
Dr. T. Hara

DURATION OF EACH PHASE:
a) Set-up and initiate experiments: 8/81 - 3/82
b) Conclusive experiments, results, publications: 4/82 - 3/85

APPROXIMATE COST: a) $ 8,000; b) $18,000/annum

OBJECTIVES: To determine effects of acid waters on spatial distribution and abundance of selected freshwater organisms, by investigating preference/avoidance responses, effects on swimming performance and locomotor activity of fish, and on drift behaviour of invertebrates.

METHOD: A combination of laboratory and field experiments is used. Recording of locomotor activity of lake whitefish (Coregonus clupeaformis), brook trout (Salvelinus fontinalis), Arctic charr (Salvelinus aplinus) and white sucker (Catostomus commersoni) in field cages and lab aquaria, studies on preference/avoidance responses and maximum sustained swimming speeds of these species in existing lab set-ups with subsequent field checks, analysis of drift behaviour of selected stream dwelling invertebrates mainly in laboratory stream channels.

ANTICIPATED RESULTS: Above methods have been successfully applied internationally to assess ecological effects of a number of organic and inorganic chemical compounds, comparable data on effects of acidified waters are scarce. Results will determine effects of acidification on responses directly underlying spatial distribution and abundance, namely selection and maintenance of habitat by freshwater organisms, with attention to possible mitigative adaptation mechanisms under chronic exposure.

SUBJECT CODE: 3.1.4

PROJECT NUMBER: 234

TITLE: Contamination of the Fishery by Mercury and Other Heavy Metals from Atmospheric Deposition: Acclimation, Dynamics and Toxicology of Metals in Fish

PRINCIPAL INVESTIGATOR'S NAME: J.F. Klaverkamp

AGENCY AND DEPARTMENT: Department of Fisheries & Oceans

ADDRESS: Freshwater Institute
501 University Crescent
Winnipeg, Manitoba
R3T 2N6

PHONE: (204) 269-7379

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: To 1984

APPROXIMATE COST: $17,000

OBJECTIVES: To investigate the degree of heavy metal contamination of the fishery located near the base metal smelter in Flin Flon, Manitoba; and to investigate some biological effects (e.g. increased resistance to lethal concentration of metals; metallothionein levels in gill, gut and liver) of this metal fallout on fish.

METHOD: Experimental methods for fish capture, metal exposures, radio-tracer detection and biochemical analyses have been developed and applied. Using radiolabelled metals, e.g. Hg203, Cd109, Zn65 and Se75, and tube enclosures, factors (viz. acid, calcium, selenium) influencing uptake and distribution in fish are examined. Using traditional laboratory acute lethality methods, increased tolerance development to metals in fish exposed to sublethal concentrations of these metals is determined. Correlation of increased tolerance to increased concentration of metallothionein in vital organs, e.g. gill, liver, and gut, is determined. Increased metallothionein concentrations in fish exposed to atmospheric fallout of metals at Flin Flon has been quantified.

ANTICIPATED RESULTS:

1) Fish impacted by smelter emissions will be contaminated by heavy metals.
2) Fish in the natural environment can acclimate to heavy metal toxicity if exposure increases gradually.
3) These fish will have elevated metallothionein (MTN) levels.
4) MTN and other biochemical indicators of stress will be evaluated on acidification impacted fish.

PROJECT NUMBER: 235

SUBJECT CODE: 3.1.4

TITLE: Water Quality Data for Namur Lake near Fort McMurray

PRINCIPAL INVESTIGATOR'S NAME: Dr. Mark Akena

AGENCY AND DEPARTMENT: Water Quality Control Branch, Pollution Control Division, Alberta Environment

ADDRESS: 6th Floor, Oxbridge Place
9820 - 106 Street
Edmonton, Alberta
T5K 2J6

PHONE: (403) 427-5828

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: Commenced in 1982

APPROXIMATE COST: $10,000 (82-83)

OBJECTIVES: This is a "Trophy Fisheries Lake" study designed to acquire baseline data on biological and hydrological cycles as well as parameters important for acid deposition monitoring.

METHOD: Contact principal investigator for project procedures.

ANTICIPATED RESULTS:

SUBJECT CODE: 3.1.4

PROJECT NUMBER: 236

TITLE: Acid Stress on Fish Neuro-Endocrine Systems

PRINCIPAL INVESTIGATOR'S NAME: Dr. T.J. Hara, S.B. Brown, B.E. Thompson and R.E. Evans

AGENCY AND DEPARTMENT: Department of Fisheries and Oceans

ADDRESS: Freshwater Institute
501 University Crescent
Winnipeg, Manitoba
R3T 2N6

PHONE: (204) 269-7379

COOPERATING AGENCIES AND INVESTIGATORS: Dr. J.G. Eales, Department of Zoology
University of Manitoba
Dr. K.A. Jones, Contract

DURATION OF EACH PHASE: 1981 - 1984

APPROXIMATE COST: Approximately $25,000 per annum

OBJECTIVES: To investigate effects of acid stress on the following neurohumoral systems regulating electrolyte metabolism and reproductive development in fish:

1) Hypothalamo-pituitary-adrenal,
2) Pituitary-thyroidal,
3) Pituitary-gonadal; and effects on sensory neural inputs to hypothalamo-pituitary system and associated fish behaviour (feeding, migration).

METHOD: Fish at different stages will be acutely and chronically exposed to various levels of acid stress and the following neural and endocrine functions examined:

1) Hypothalamo-pituitary, thyroid, adrenal and gonadal histology to identify pathological changes in these glands.
2) Dynamics of plasma hormones - corticosteroids, thyroid hormones (T_4 and T_3 and their conversion), sex steroids - using radioimmunassay procedures.
3) Treatment of fish with appropriately labelled hormone or precusor to determine production and degration rates under acid stress (if time permits).
4) Measurements of related variables such as plasma protein, electrolytes, glucose and iodide levels.
5) Sensory neural inputs (olfactory) to hypothalamo-pituitary system and associated fish behaviour such as feeding, spawning and migration.

ANTICIPATED RESULTS:

1) Identification of the direct effects of acid stress on the described neuro-endocrine functions.
2) Integration of these effects with those of ionic-osmotic regulation and cardiovascular-respiratory systems.
3) Identification of an endocrinological sensitivity profile to estimate the degrees of stress in previously acidified aquatic systems.
4) Provide information on acid stress on endocrine systems and chemical (olfactory) orientation involved in diadromous migration of salmonids.

PROJECT NUMBER: 237

SUBJECT CODE: 3.1.4

TITLE: Effects of pH on Overwintering Young-Of-The-Year Smallmouth Bass

PRINCIPAL INVESTIGATOR'S NAME: G. Cunningham

AGENCY AND DEPARTMENT: Department of Zoology

ADDRESS: University of Toronto
Toronto, Ontario

PHONE:

COOPERATING AGENCIES AND INVESTIGATORS: B. Shuter, Ontario Ministry of Natural Resources and
H. Regier, University of Toronto

DURATION OF EACH PHASE: 04/1982 - 03/1983

APPROXIMATE COST: $16,000 - 1982/83

OBJECTIVES: To develop an understanding of the impact of acidic deposition on smallmouth bass.

METHOD: Laboratory studies examining survival and condition of young-of-the-year smallmouth bass exposed to waters of varying hydrogen ion concentrations.

ANTICIPATED RESULTS: An improved understanding of the relationship of water chemistry to survival of smallmouth bass at a critical period of their life history.

SUBJECT CODE: 3.1.4

PROJECT NUMBER: 238

TITLE: Comparison of Present with Historic Distributions of Fish Species in Relation to Acidification of Their Habitats

PRINCIPAL INVESTIGATOR'S NAME: W.J. White

AGENCY AND DEPARTMENT: Department of Fisheries and Oceans

ADDRESS: Fisheries Research Branch
P.O. Box 550
Halifax, Nova Scotia
B3J 2S7

PHONE: (902) 426-3576

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: Field studies April 1 to March 31, 1983.
Report writing 1984

APPROXIMATE COST: $10,000 O & M; $5,000 Capital

OBJECTIVES: To determine whether species of fish have vanished from regions of Nova Scotia where formerly they were found and to discover whether disappearances of species can be related to pH changes and pH tolerances.

METHOD: Various sampling methods will be used to sample fish in rivers and lakes where museum records and scientific literature indicate sampling was carried out in earlier periods. Results will be compared with earlier records. Accurate chemical sampling will also be carried out.

ANTICIPATED RESULTS: A technical report and possibly a publishable paper will be prepared. The results may document damage to fish habitat in Canada by acid rain.

PROJECT NUMBER: 239

SUBJECT CODE: 3.1.4

TITLE: Survey of Geographical Distribution of Fish in Nova Scotia in Relation to pH of Water

PRINCIPAL INVESTIGATOR'S NAME: W.J. White

AGENCY AND DEPARTMENT: Fisheries & Oceans, Resource Branch

ADDRESS: Freshwater & Anadromous Division
P.O. Box 550
Halifax, Nova Scotia
B3J 2S7

PHONE: (902) 426-3576

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: 4 year study
Trapping and electroseining - 1980 - 1982
Report writing - 1983

APPROXIMATE COST: $10,000/year 1980/82 $5,000/year 1982/83

OBJECTIVES: To demonstrate the effects of pH of surface waters on natural populations of fish in their natural habitat.
To find approximately the limit of pH tolerance of fish populations in their natural habitat in Nova Scotia.

METHOD: Several methods of collecting fish including electroseining and netting will be used. pH measurements will be carried out at numerous points to determine the range of variation of pH within a river system.

ANTICIPATED RESULTS:

1) The physiological tolerance limits of individual fish at different stages in their life history are well known for many species. The lowest pH under which populations can maintain themselves may be somewhat higher than the limit for individuals in the population.

2) A preliminary report on 1980-82 results is in preparation.

SUBJECT CODE: 3.1.4

PROJECT NUMBER: 240

TITLE: Modelling of Impact of Acidic Precipitation on Ontario's Fisheries Resources

PRINCIPAL INVESTIGATOR'S NAME: J.A. MacLean and G.L. Beggs

AGENCY AND DEPARTMENT: Environmental Dynamics Section
Fisheries Branch

ADDRESS: Ontario Ministry of Natural Resources
Whitney Block, Queen's Park
Toronto, Ontario
M7A 1W3

PHONE: (416) 965-7887

COOPERATING AGENCIES AND INVESTIGATORS: M. Jones - Environmental and Social Systems Analysts
103 Meadowvale Drive, Toronto, Ontario
Ontario Ministry of the Environment
Fisheries and Oceans, Canada

DURATION OF EACH PHASE: 04/1982 - 09/1982

APPROXIMATE COST: $65,000

OBJECTIVES: To synthesize our understanding of the effects of acidic deposition on Ontario's fisheries and develop explicit estimates of resource loss under a variety of loading scenarios.

METHOD: Use an Adaptive Environmental Assessment and Management approach to examine the effects of acidic deposition on Ontario's fisheries resources; development and refinement of models using a series of small technical meetings.

ANTICIPATED RESULTS:

1) Explicit estimates of the rate and extent of fisheries resource loss.
2) Assessment of current understanding of effect.
3) Priorization of research needs.

PROJECT NUMBER: 241

SUBJECT CODE: 3.1.4

TITLE: Extensive Survey

PRINCIPAL INVESTIGATOR'S NAME: D. Wales

AGENCY AND DEPARTMENT: Environmental Dynamics Section
Fisheries Branch

ADDRESS: Ontario Ministry of Natural Resources
Whitney Block, Queen's Park
Toronto, Ontario
M7A 1W3

PHONE: (416) 965-7887

COOPERATING AGENCIES AND INVESTIGATORS: Ontario Ministry of the Environment
P. Dillon

DURATION OF EACH PHASE: 04/1982 - 03/1985

APPROXIMATE COST: Approximately $70,000/year

OBJECTIVES: Estimate the current chemical and biological status of the resource to provide a basis of extrapolation from intensive work.

METHOD:

1) Data Review - compilation and computerization of Ontario extensive water chemistry and fisheries data, with subsequent review of coverage according to: watershed, geology, morphometry, community type, etc.

2) Collection of additional data according to the needs identified in #1.

ANTICIPATED RESULTS:

1) A basis of extrapolation from intensive studies.

2) Estimates of the current status of Ontario waterbodies in terms of sensitivity to acidic deposition.

SUBJECT CODE: 3.1.4

PROJECT NUMBER: 242

TITLE: Comparative Lake Study

PRINCIPAL INVESTIGATOR'S NAME: J. Gunn

AGENCY AND DEPARTMENT: Sudbury District Office
Ontario Ministry of Natural Resources

ADDRESS:

PHONE: (705) 522-7823

COOPERATING AGENCIES AND INVESTIGATORS: Ontario Ministry of the Environment
N. Conroy and B. Keller

DURATION OF EACH PHASE: 04/1982 - 03/1983

APPROXIMATE COST: Approximately $25,000/yearly

OBJECTIVES: To refine and test our understanding of the impact of acidic deposition on fish.

METHOD: 1982-83 - Comparison of lake trout populations, particularly age, growth, feeding, fecundity and contaminant levels, in lakes with water chemistry conditions which bracket suspected toxicity thresholds for lake trout.

ANTICIPATED RESULTS:
1) Field test of laboratory and *in situ* bioassay results.
2) Refine and test models of impact.

PROJECT NUMBER: 243

SUBJECT CODE: 3.1.4

TITLE: Trend-Through-Time Assessment of Impact of Acidic Precipitation on Fish Communities

PRINCIPAL INVESTIGATOR'S NAME: F. Hicks and T. Stewart

AGENCY AND DEPARTMENT: Ontario Ministry of Natural Resources

ADDRESS:

PHONE:

COOPERATING AGENCIES AND INVESTIGATORS: Ontario Ministry of the Environment
P. Dillon

DURATION OF EACH PHASE: 04/1982 - 03/1985

APPROXIMATE COST: $100,000/year

OBJECTIVES: To refine and test our understanding of the impact of acidic deposition on aquatic ecosystems.

METHOD: Collection of trend-through-time information on water chemistry and biota in 12 extremely susceptible lakes subjected to high acidic deposition.

ANTICIPATED RESULTS:

1) Establish baseline data and document changes in water chemistry and biota in extremely sensitive lakes.
2) Refine and test models of impact.

SUBJECT CODE: 3.1.4

PROJECT NUMBER: 244

TITLE: Effect of Acidification on Fish Populations

PRINCIPAL INVESTIGATOR'S NAME: K.H. Mills

AGENCY AND DEPARTMENT: Department of Fisheries and Oceans

ADDRESS: Freshwater Institute
501 University Crescent
Winnipeg, Manitoba
R3T 2N6

PHONE: (204) 269-7379

COOPERATING AGENCIES AND INVESTIGATORS:
S. Chalanchuk
L. Mohr
N. Arnason - University of Manitoba

DURATION OF EACH PHASE:

APPROXIMATE COST: $30,000

OBJECTIVES: To document changes in growth, fecundity, mortality, fitness and numbers of key fish species in the acidified lakes, and to compare these parameters with unstressed populations.

METHOD: Mark and recapture of some fishes from Lakes 223 and 302; catch per unit effort for cyprinids, Fin-ray samples taken from ageing, other appropriate measurements made. Population statistics calculated as described by Mills and Arnason.

ANTICIPATED RESULTS: Conclusions regarding pH thresholds and sensitive life stages for several species of fishes. Identification of direct toxic and indirect (food chain) effects on natural fish populations.

PROJECT NUMBER: 245

SUBJECT CODE: 3.1.4

TITLE: Laboratory Studies on Early Development of Fish at Low pH

PRINCIPAL INVESTIGATOR'S NAME: Dr. R.H. Peterson

AGENCY AND DEPARTMENT: Department of Fisheries and Oceans

ADDRESS: Biological Station
St. Andrews, New Brunswick
E0G 2X0

PHONE: (506) 529-8854

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: Open

APPROXIMATE COST: 1982/83 10K

OBJECTIVES: Hatched salmonid alevins have a requirement for exogenous Ca^{++}, Na^{+}, and K^{+} (and possibly other ions) with accumulation increasing exponentially during yolk absorption. Preliminary results indicate that this accumulation is reduced at low pH. Further research will focus on sites of uptake, how low pH reduces accumulation, the effect of the ion deficiency on the viability of resultant fry, and comparative aspects (species differences etc.). The effects of ambient ion concentration on accumulation will also be investigated.

METHOD: Ambient pH will be controlled by pH-stat apparatus in a continuous-flow system. Ambient concentrations of ions will be regulated by standard dosing procedures. Total ions will be measured by standard atomic absorption spectroscopy on ion chromatography. In vivo measurements will be made with micro-ion selective electrodes.

ANTICIPATED RESULTS: These studies will provide information on the mechanisms whereby low pH affects the early development of fish.

SUBJECT CODE: 3.1.4

PROJECT NUMBER: 246

TITLE: Studies on Reproduction of Atlantic Salmon in an Acid Stream

PRINCIPAL INVESTIGATOR'S NAME: Mr. H. C. Freeman

AGENCY AND DEPARTMENT: Fisheries Environmental Research, FES

ADDRESS: Department of Fisheries and Oceans
P.O. Box 550
Halifax, Nova Scotia
B3J 2S7

PHONE: (902) 426-6291

COOPERATING AGENCIES AND INVESTIGATORS: DFO Mersey Hatchery

DURATION OF EACH PHASE: 3 Years

APPROXIMATE COST: $10.5K

OBJECTIVES: Determine effects of low ambient pH on gametogenesis in adult Atlantic salmon.

METHOD: Sexually maturing Atlantic salmon will be held at controlled pH levels, and will also be sampled from the Westfield River until initiation of spawning. Effects of liming and aluminum will also be investigated. Steriod hormone metabolism, blood calcium levels, and egg number, size and fertility will be investigated.

ANTICIPATED RESULTS: Determination of effects of low pH and aluminum on steroid hormone metabolism, gonad maturation, and reproduction.

PROJECT NUMBER: 247

SUBJECT CODE: 3.1.4

TITLE: Biochemical Toxicology of Acid pH to Aquatic Fauna

PRINCIPAL INVESTIGATOR'S NAME: Dr. K. Haya

AGENCY AND DEPARTMENT: Department of Fisheries and Oceans

ADDRESS: Biological Station
St. Andrews, New Brunswick
E0G 2X0

PHONE: (506) 529-8854

COOPERATING AGENCIES AND INVESTIGATORS: Drs. R. L. Saunders, R. H. Peterson

DURATION OF EACH PHASE: 3 Years

APPROXIMATE COST: $20K

OBJECTIVES: Develop biochemical indices of sublethal pH stress in aquatic fauna from acidic streams. Provide aid in assessment of overall health of aquatic communities in acidic environments.

METHOD: 1) Further studies to examine the role of chorionase on hatching success of various fish species in streams of low pH are being conducted.

2) A biochemical parameter considered potentially useful as an indicator of pollutant stress is adenylate energy charge (AEC) - a measure of the metabolic energy available for cellular metabolism. The following experiments will assess the potential of AEC as an indicator of sublethal stress in aquatic fauna to acidic habitats: (a) AEC during laboratory exposure of salmon parr to acid pH; (b) comparison of AEC in samples of fauna from acidic and non-acidic freshwater bodies; (c) AEC of Salmo salar during the smolting process in laboratory controlled variations in pH, (d) AEC of smolts leaving the Westfield study area and other acid and non-acidic streams.

ANTICIPATED RESULTS: pH activity profiles of chorionase and AEC. Activity profiles of chorionase and AEC for fauna from streams with differing ambient pH.

SUBJECT CODE: 3.1.4

PROJECT NUMBER: 248

TITLE: Smolting of Atlantic Salmon at Low pH

PRINCIPAL INVESTIGATOR'S NAME: Dr. R. L. Saunders

AGENCY AND DEPARTMENT: Department of Fisheries and Oceans

ADDRESS: Biological Station
St. Andrews, New Brunswick
E0G 2X0

PHONE: (506) 529-8854

COOPERATING AGENCIES AND INVESTIGATORS: Dr. K. Haya, St. Andrews (Biological Station)
Dr. C. E. Johnston, University of Prince Edward Island

DURATION OF EACH PHASE: 3 Years

APPROXIMATE COST: $20K

OBJECTIVES: To determine whether juvenile Atlantic salmon undergo normal smolting processes in the Westfield River.

METHOD: Juvenile salmon in the Westfield River will be analyzed for various parameters associated with smolting (and migration to sea), such as salinity tolerance and gill ATPase activity. Samples will be collected in winter and early spring when smolting occurs.

ANTICIPATED RESULTS: Assessment of the success of parr-smolt transformation in streams of low pH.

PROJECT NUMBER: 249

SUBJECT CODE: 3.1.4

TITLE: Avoidance of low pH by Freshwater Fishes

PRINCIPAL INVESTIGATOR'S NAME: Dr. R. H. Peterson

AGENCY AND DEPARTMENT: Department of Fisheries and Oceans

ADDRESS: Biological Station
St. Andrews, New Brunswick
E0G 2X0

PHONE: (506) 529-8854

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: 4 Years

APPROXIMATE COST: $5K O&M

OBJECTIVES: To determine the preferred pH range of several freshwater fish species (Atlantic salmon, brook trout, white sucker, blacknose dace), and to determine the influence of dissolved humic substances on the preferred range.

METHOD: An apparatus has been constructed consisting of 3 channels interconnected by apertures, the size of which can be varied. Water velocity, temperature, and pH can be independently varied in each channel. Fish can move among channels through the apertures. Groups of 6-12 fish (depending on size) will be placed in the apparatus with all channels at "control" pH, and their distribution will be observed for several days to determine distributional biased interest in the apparatus. pH will then be varied among the channels and distributional changes noted. Over the course of many experiments, avoidance preference ranges for the various species will be determined.

ANTICIPATED RESULTS: Primary publications on mechanisms of low pH avoidance by fish.

SUBJECT CODE: 3.1.4

PROJECT NUMBER: 250

TITLE: Territorial and Feeding Behaviour of Juvenile Atlantic Salmon at Various pH Levels

PRINCIPAL INVESTIGATOR'S NAME: Dr. R. H. Peterson

AGENCY AND DEPARTMENT: Department of Fisheries and Oceans

ADDRESS: Biological Station
St. Andrews, New Brunswick
E0G 2X0

PHONE: (506) 529-8854

COOPERATING AGENCIES AND INVESTIGATORS: Washburn and Gillis Inc.
Fredericton, N.B.
(Dr. D. Townsend)

DURATION OF EACH PHASE: 14 months

APPROXIMATE COST: $10K O&M

OBJECTIVES: To determine if feeding and territorial behaviour of Atlantic salmon juveniles are modified at low pH levels.

METHOD: An artificial stream apparatus is being constructed and evaluated. Chemical technology for removing Ca^{++} from water and adjusting pH is being installed. Juvenile Atlantic salmon will be placed in the apparatus at realistic densities. Their feeding and territorial behaviour will be observed at several experimental pH levels.

ANTICIPATED RESULTS: Primary publications revealing effects of low pH on territorial and feeding behaviour of juvenile Atlantic salmon.

PROJECT NUMBER: 251

SUBJECT CODE: 3.1.4

TITLE: Intensive Study of the Ecology of Atlantic Salmon in an Acidified Stream

PRINCIPAL INVESTIGATOR'S NAME: Dr. G. L. Lacroix

AGENCY AND DEPARTMENT: Department of Fisheries and Oceans

ADDRESS: Biological Station
St. Andrews, New Brunswick
EOG 2XO

PHONE: (506) 529-8854

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: 5-10 Years

APPROXIMATE COST: 1982/83 $180K

OBJECTIVES: To determine reproductive success and productivity of fish populations in the Westfield River, a stream with mean annual pH ca. 4.9 (mean discharge of 30 $L/S/Km^2$), to determine the importance of anadromous and catadromous fish populations to stream productivity and nutrient flow within the stream ecosystem, and assess what loss of these populations through acidification means to the ecosystem; to thoroughly investigate nutrient fluxes and sources of acidity within the stream ecosystem, to determine the influence of low pH on species assemblages of freshwater stream communities; to determine the relative importance of heavy metals and pH on the fish populations.

METHOD: A permanent study area in a section of stream utilized heavily for reproduction by Atlantic salmon will be set up. Counting fences will be installed at the boundaries of the study area to assess migrations in and out of the area. Periodic stream censuses and marking procedures will be performed in the study area to assess population parameters. Nutrient (and other ions) analyses will be performed periodically on water samples and on fish tissues to assist in generation of nutrient budgets. Productivity and nutrient content of periphyton and benthic invertebrates will be measured. Three gauging stations will be installed, such that characteristics of the hydrology of the drainage basin can be assessed and modelled. Precipitation contributions to the stream can be assessed from data being collected at the Kejimkujik calibrated watershed study. Stream drift samples will be used to assess invertebrates and particulate fluxes through the study area. Comparative studies will be performed on various aspects using other streams with differing water chemistries where necessary and appropriate.

ANTICIPATED RESULTS:

- Assessment of reproduction, growth rates, mortalities, population numbers, and productivity of various fish species in the Westfield River at various stages in the freshwater phase of the life cycle. Attention will be focussed on the Atlantic salmon population.

- Assessment of the role of anadromous and catadromous fish species in the nutrient budgets of an acid-stressed stream.

- Assessment of the responses of the water chemistry of the drainage system to seasonal fluctuations in precipitation and runoff, and the effects of these changes on fish and stream invertebrates.

- Determination of the roles of low pH and heavy metals on fish reproduction in a brown water stream.

CODE DU SUJET: 3.1.4

NUMÉRO DE PROJET: 252

TITRE: Relation entre le niveau d'acidité des lacs du parc des Laurentides et le succès de pêche

NOM DU CHERCHEUR RESPONSABLE: Yvon Richard

MINISTÈRE, ORGANISME OU ORGANISME PRIVÉ, SERVICE: Service de la qualité des eaux
Ministère de l'Environnement du Québec (MENVIQ)

ADRESSE: 2360, chemin Ste-Foy
Ste-Foy, Québec
G1V 4H2

TÉLÉPHONE: (418) 643-4425

COLLABORATEUR(S), ORGANISME(S) ET CHERCHEUR(S): Ministère du Loisir, de la Chasse et de la Pêche (MLCP)
Laboratoires de Québec - MENVIQ

DURÉE DE CHAQUE PHASE:

COÛT APPROXIMATIF:

Activité 1 - automne 1981:	5 000$	(MENVIQ)
Activité 2 et 3 - hiver 1981:	15 000$	(MENVIQ)
Activité 4 - hiver 1981 et automne 1981:	15 000$	(MENVIQ)

OBJECTIFS DE TRAVAIL: Établir la relation entre le degré d'acidité des lacs du parc des Laurentides et leur productivité piscicole, et vérifier si les populations d'ombles de fontaine ont subi des modifications au cours des dernières années.

MÉTHODE DE TRAVAIL:

1) Compilation des statistiques de pêche pour les lacs du parc des Laurentides.
2) Prise d'un échantillon intégré (0 - 5m) d'eau au centre géométrique de 158 lacs du parc.
3) Analyse des ions majeurs, des paramètres physico-chimiques reliés à l'acidification, et de l'aluminium.
4) Traitement et interprétation des résultats.

RÉSULTATS PRÉVUS:

NUMÉRO DE PROJET: 253

CODE DU SUJET: 3.1.4

TITRE: Effets ecotoxicologiques de l'aluminium en relation avec les précipitations acides chez les poissons

NOM DU CHERCHEUR RESPONSABLE: R. Van Coillie

MINISTÈRE, ORGANISME OU ORGANISME PRIVÉ, SERVICE: ECO-RECHERCHES INC. (filiale de C-I-L)

ADRESSE: 121 boul. Hymus,
Pointe Claire, Québec
H9R 1E6

TÉLÉPHONE:

COLLABORATEUR(S), ORGANISME(S) ET CHERCHEUR(S):

DURÉE DE CHAQUE PHASE:

COÛT APPROXIMATIF: $90,000

OBJECTIFS DE TRAVAIL: Préciser le danger toxique de l'exces d'aluminium provenant du bouclier Canadien altere par les précipitations acides, vis-a-vis des salmonides.

MÉTHODE DE TRAVAIL: LC50 aluminium saumon et truite

Toxicité sous-letale aluminium pour les salmonides a pH acides

Effets hyper-respirometriques et branchiaux aluminium

Bioaccumulation Al dans branchies, foie, muscles salmonides

Effets protéiques induits

RÉSULTATS PRÉVUS:

SUBJECT CODE: 3.1.4

PROJECT NUMBER: 254

TITLE: APIOS: Fisheries Program

PRINCIPAL INVESTIGATOR'S NAME: J. R. Munro
T. Pawson
K. Holtze

AGENCY AND DEPARTMENT: Ontario Ministry of the Environment

ADDRESS: P.O. Box 39
Dorset, Ontario
POA 1E0

PHONE: (705) 766-2511

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: 1983/85

APPROXIMATE COST: 1983/84: $180K

OBJECTIVES: To develop lethal and sublethal thresholds of pH, Al and other metals for early life history stages for several fish species including laketrout, brooktrout, and rainbowtrout, smallmouth bass and lake whitefish.

METHOD:

1) Field in-situ bioassays will be conducted over a wide range of water chemistry conditions. Exposures will range in duration from one day to five months.

2) Laboratory dose-response data will be developed for each species at a number of early life stages using continuous flow exposures.

ANTICIPATED RESULTS: Results will be used to model fish population responses to predicted changes in lake water chemistry due to acid deposition. (in cooperation with OMNR)

PROJECT NUMBER: 255

SUBJECT CODE: 3.1.4

TITLE: APIOS: Fisheries Program Fish Contaminants In Poorly Buffered Ontario Lakes

PRINCIPAL INVESTIGATOR'S NAME: K. Suns

AGENCY AND DEPARTMENT: Ontario Ministry of the Environment

ADDRESS: P.O. Box 213
Rexdale, Ontario
M9W 5L1

PHONE: (416) 248-3011

COOPERATING AGENCIES AND INVESTIGATORS: Ontario Ministry of Natural Resources

DURATION OF EACH PHASE: 1983/84 Fiscal Year

APPROXIMATE COST: 1983/84: $31K

OBJECTIVES:

1) Develop fish contaminants data for a portion of the trends-with-time lakes and comparative lakes

2) Assess the relationship between atmospheric loading of contaminants and its effect on fish uptake in poorly buffered lakes.

METHOD: Sportfish (bass, brooktrout, laketrout) and yearling yellow perch will be collected and analyzed for mercury residues from selected lakes for trend evaluation.

Contaminant residue relationships will be established between the sportfish and yearling perch.

Yearling perch will be collected and analyzed from areas where low, intermediate and high levels of acidic precipitation has been observed.

ANTICIPATED RESULTS: Will have mercury data for about 7 trends-with-time lakes and 15 comparative lakes. Data will include sportfish and yearling perch. Will demonstrate either the presence or absence of relationships between atmospheric loading and mercury uptake in Ontario lakes.

SUBJECT CODE: 3.1.4

PROJECT NUMBER: 256

TITLE: APIOS: Fisheries Program Sublethal Effects of Acid and Monomeric Inorganic Al in the Presence of Organic Al Species on Juvenile Fish

PRINCIPAL INVESTIGATOR'S NAME: Dr. C. M. Neville

AGENCY AND DEPARTMENT: Ontario Ministry of the Environment

ADDRESS: P.O. Box 213
Rexdale, Ontario
M9W 5L1

PHONE: (416) 248-3011

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: Lab studies - 1983/85
Field studies - 1983/85

APPROXIMATE COST: 83/84: $35K

OBJECTIVES: To study the mechanism of aluminum toxicity to fish in acidified environments.

METHOD: Lab studies: Juvenile rainbowtrout will be exposed to acidified soft water environments with known concentrations of inorganic and organic species of Al. Ventilation, cough and oxygen consumption rates, arterial blood gas and acid-base parameers, blood and tissue electrolytes, tissue Al concentration and histopathology will be studied and compared to results of exposure to acid and monomeric inorganic Al in the absence of organic Al species.

Field studies: 1) Oxygen consumption rates, gill Al concentration and tissue electrolyte levels will be measured on fish held in streams affected by snowmelt,

2) Gill Al levels, tissue heavy metal and electrolyte levels, and swimming performance of indigenous juvenile fish in acidified and control lakes will be studied.

ANTICIPATED RESULTS: The results will increase the reliability of models to predict the effect of environmental acidification on juvenile fish.

PROJECT NUMBER: 257

SUBJECT CODE: 3.1.4

TITLE: Aluminum Toxicity in Nova Scotia

PRINCIPAL INVESTIGATOR'S NAME: W. D. Watt

AGENCY AND DEPARTMENT: Department of Fisheries & Oceans

ADDRESS: Resource Branch
Freshwater & Anadromous Division
Halifax, Nova Scotia

PHONE: (902) 426-3606

COOPERATING AGENCIES AND INVESTIGATORS: Various contractors

DURATION OF EACH PHASE: Two years

APPROXIMATE COST: $20K - 1983/84.

OBJECTIVES: To ascertain if aluminum concentrations presently at levels of 200-300 ppb will be toxic to fish and invertebrates after the pH is raised by liming.

METHOD: Flow-through bioassays using natural river waters with pH adjusted up by lime treatment.

ANTICIPATED RESULTS: Establish tolerance levels for aluminum in acidified rivers to be reclaimed by liming and/or other mitigation techniques.

CODE DU SUJET: 3.1.4

NUMÉRO DE PROJET: 258

TITRE: Inventaire National

NOM DU CHERCHEUR RESPONSABLE: Yvan Vigneault

MINISTÈRE, ORGANISME OU ORGANISME PRIVÉ, SERVICE: Pêches et Océans, Habitat du poisson

ADRESSE: Gare Maritime Champlain
901, Cap Diamant
Case Postale 15,500
Québec, Québec
G1K 7Y7

TÉLÉPHONE: (418) 694-3478

COLLABORATEUR(S), ORGANISME(S) ET CHERCHEUR(S): Le Groupe Dryade
Québec, Québec
L'Institut National de Recherche Scientifique (Eau)
du Québec, Québec.

DURÉE DE CHAQUE PHASE:

- Echantillonnage entre le 5 juillet et le 15 septembre 1982;
- Analyse, compilation et interprétation des résultats entre le 20 septembre et le 20 décembre 1982,
- Rédaction d'un rapport technique pour le 1 mars 1983.

COÛT APPROXIMATIF: 1982 - 1983: $190K

OBJECTIFS DE TRAVAIL:

- Evaluer l'état physico-chimique des lacs situés sur tout le territoire québécois s'étendant entre la rive nord du Saint-Laurent et le 52ème degré de latitude nord;
- Etudier la biologie et estimer la biomasse des lacs et identifier les régions affectées par l'acidification,
- Inventorier et caractériser l'habitat du poisson en égard à l'effet des pluies acides.

MÉTHODE DE TRAVAIL:

Sélection des lacs

La sélection des lacs a été effectée en tenant compte d'une part des résultats physico-chimiques obtenus en 1981 pour un programme similaire et d'autre part, des critères additionnels visant à augmenter la représentativité de notre échantillonnage. Les lacs choisis répondent donc aux conditions suivantes:

1) Profondeur minimum 4 m.;
2) Aucune activité humaine;
3) Longueur minimum de 1 km.;
4) Lacs de tête échantillonnés en 1981: 60%
   Lacs de 2ème et 3ème niveau hydrographique: 25%
   Lacs de tourbières: 15%.

NUMÉRO DE PROJET: 258 (cont'd)

CODE DU SUJET: 3.1.4

MÉTHODE DE TRAVAIL:

5) Répartition de ces lacs dans les 10 groupes de lacs identifiés lors de l'interprétation des résultats physico-chimiques de 1981.

Paramètres d'études

a) Physico-chimie de l'eau (250 lacs):

- Transparence, température, O_2, conductivité, pH, couleur réelle;
- Alcalinité, Carbone inorganique et organique total et dissous, Calcium, Magnésium, Nitrates, Sulfates, Potassium, Sodium, Chlorures;
- Aluminium, Fer et Manganèse;
- Cadmium, Nickel, Zinc, Cuivre et Plomb.

b) Inventaire biologique (50 lacs):

- Profondeur moyenne (bathymétrie),
- Végétation aquatique,
- Phytoplancton (récolte seulement),
- Zooplancton (récolte seulement);
- Sédiments (récolte seulement),
- Benthos (récolte seulement);
- Poissons:
  - filets expérimentaux,
  - seines;
  - mesures et prélèvements,
  - analyse des chairs de poissons.

RÉSULTATS PRÉVUS:

- Détermination de la qualité de l'eau et du niveau d'acidification des lacs échantillonnsé,
- Evaluation de l'état de leurs populations de poissons,
- Acquisition de données de base concernant la physico-chimie et la productivité des lacs choisis, en relation avec l'acidification;
- Evaluation de l'impact des pluies acides sur la structure des communautés lacustres (plancton, benthos, poisson, végétation).

CODE DU SUJET: 3.1.4

NUMÉRO DE PROJET: 259

TITRE: Effet des pluies acides sur le système caudal neurosécreteur de la truite

NOM DU CHERCHEUR RESPONSABLE: Dr. Gaston Chevalier

MINISTÈRE, ORGANISME OU ORGANISME PRIVÉ, SERVICE: Dép. Sc. Biologiques, Université du Québec à Montréal

ADRESSE: C.P. 888
Montréal, Québec
H3C 3P8

TÉLÉPHONE: (514) 282-3342

COLLABORATEUR(S), ORGANISME(S) ET CHERCHEUR(S): Dr. Howard Bern
Dept. Zoology
University of California
Berkeley, Calif.

DURÉE DE CHAQUE PHASE: Septembre 1981 - 1984

COÛT APPROXIMATIF: 82-83: $18K 83-84: $18K 84-85: $18K

OBJECTIFS DE TRAVAIL:
- évaluer l'effet d'un environnement acidifie sur l'acitvité du système caudal neurosécréteur de la truite mouchetée, en vue d'etablir un indice de toxicitté précace à l'égard du pH externe et des métaux toxiques (Al, Cd, Hg).

MÉTHODE DE TRAVAIL:
- dosage de l'hormone urotensine II par bio-essai
- évaluation ultrastructurale par microscopie électronique.

RÉSULTATS PRÉVUS:
- comparison d'indices d'acitivité urophysaive chez des populations de lacs acidifiés vs lacs non acidifiés.

NUMÉRO DE PROJET: 260

CODE DU SUJET: 3.1.4

TITRE: Ecotoxicologie de l'aluminium pour le saumon et l'omble de fontaine

NOM DU CHERCHEUR RESPONSABLE: Yvan Vigneault

MINISTÈRE, ORGANISME OU ORGANISME PRIVÉ, SERVICE: Pêches et Océans, Habitat du poisson

ADRESSE: Gare Maritime Champlain
901, Cap Diamant
Case Postale 15,500
Québec, Québec
G1K 7Y7

TÉLÉPHONE: (418) 694-3478

COLLABORATEUR(S), ORGANISME(S) ET CHERCHEUR(S): Eco-Recherche Inc.
Montréal, Québec

DURÉE DE CHAQUE PHASE:
- Expérimentation en laboratoire effectuée entre octobre 1981 et mai 1982;
- Rapport préliminaire disponible vers le 1 septembre 1982.

COÛT APPROXIMATIF: 1981 - 1982: $65K 1982 - 1983: $20K

OBJECTIFS DE TRAVAIL:
- Déterminer les concentrations létales d'aluminium à différents pH pour le saumon et l'omble de fontaine,
- Comparer la sensibilité des deux espèces à l'aluminium,
- Déterminer les concentrations sous-létales d'aluminium pouvant affecter le comportement des espèces,
- Etudier la toxicité des différentes formes de spéciation de l'aluminium et l'influence des acides humiques.

MÉTHODE DE TRAVAIL: Utilisation d'eau déionisée à laquelle seront ajoutés des cations majeurs (Ca, Mg, Na, K) et de l'aluminium inorganique ($Al(OH_3)$ ou $AlPO_4$) ou organique selon les tests. Pour chaque solution préparée, les paramètres suivants seront contrôlés et analysés: pH, alcalinité, dureté, conductivité, sulfates, nitrates, chlorures et aluminium total ou organique d'après un modèle de l'INRS-Eau.

Test 1: Toxicité létale.

On compare tour à tour la sensibilité du saumon et de la truite d'âge 0^+ dans des tests dynamiques (à flux continu) de sept (7) jours effectués en duplicata (cinq (5) concentrations et un contrôle) pour différentes concentrations d'aluminium organique et inorganique à des pH de 4.5 ou 5.5 et des alcalinités de 10-13 mg/l ou 30-35 mg/l. Ces bio-essais sont réalisés dans des bassins de polypropylène de 30 l. avec un minimum de 10 organismes par bassin, avec renouvellement de la solution par des pompes proportionnelles.

CODE DU SUJET: 3.1.4

NUMÉRO DE PROJET: 260 (cont'd)

MÉTHODE DE TRAVAIL:

Test 2: Effet sous-létal.

Le montage est composé de deux (2) bassins cylindriques en polypropylène d'une capacité de 30 l. chacun, lesquels sont reliés entre eux par une ouverture de 7.5 cm à leur base. L'écoulement de l'eau se fait de façon unidirectionnelle, avec ajout d'aluminium du côté de la zone cible à la hauteur du tube central. Dix (10) saumons d'âge 1^+ sont placés dans ce système. Après une période de pré-adaptation, on compte le nombre de poissons dans chaque bassin (un avec aluminium, un sans aluminium) à toutes les 15 secondes, puis on calcule les moyennes.

Test 3: Test de préférence.

Avec le montage du test précédent, on observera la distribution des individus dans deux (2) bassins avec des conditions physico-chimiques (Al, pH et alcalinité) différentes.

RÉSULTATS PRÉVUS:

- Evaluation des concentrations critiques d'aluminium pour le poisson, selon les différents pH et différentes conditions d'alcalinité,
- Détermination des formes les plus toxiques de l'aluminium dans l'eau.

PROJECT NUMBER: 261

SUBJECT CODE: 3.1.4

TITLE: Partitioning and Bioaccumulation of Heavy Metals by Functional Groups of Zoobenthos in Acidifying Lakes

PRINCIPAL INVESTIGATOR'S NAME: Gerald L. MacKie

AGENCY AND DEPARTMENT: University of Guelph, Department of Zoology

ADDRESS: Department of Zoology
University of Guelph
Guelph, Ontario
N1G 2W1

PHONE: (519) 824-4120

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: 3 years, beginning January 1983

APPROXIMATE COST: $40K per year

OBJECTIVES: 1) To determine the toxicity of organic and inorganic monomeric aluminum to dominant and impactable species of zoobenthos in four functional groups (collectors, scrapers, shredders, predators) at pH's characteristic of spring and fall depression periods;

2) to determine if aluminum, lead, and cadium are partitioned differentially among the four functional groups of zoobenthos in acidifying lakes; and

3) to determine if the body burdens of heavy metals (Al, Pb, Cd) and the productivity of populations within the functional groups are viable indicators of heavy metal contamination in the aquatic environment.

METHOD: 1) Both field and laboratory studies will be used.

2) Static 96 hr LC50 and LT50 bioassays will be used to determine the toxicity of inorganic and organic monomeric aluminum relative to pH for species zoobenthos in four functional groups.

3) The effects of spring and fall pH depressions on survival and growth rates will be evaluated by, rearing the species being examined in cages placed in a trough system located at the outflow of Plastic Lake near Dorset, Ontario.

4) Samples of benthos will be collected from at least four lakes (pH ranging from 5 to 6.5) and will be analyzed for aluminum, lead and zinc. Relationships between body burdens of each metal, total metal concentrations in the water and sediment, and productivity of functional groups, will be derived seasonally. This will permit an assessment of the use of the productivity of functional groups and the body burdens of heavy metals (Al, Pb, Cd) in representative species of zoobenthos as indicators of heavy metal contamination in acidifying lakes.

SUBJECT CODE: 3.1.5

PROJECT NUMBER: 262

TITLE: Lake Sediment Studies

PRINCIPAL INVESTIGATOR'S NAME: P. Dillon

AGENCY AND DEPARTMENT: Ministry of the Environment

ADDRESS: P.O. Box 213
Rexdale, Ontario
M9W 5L1

PHONE: (416) 248-3058

COOPERATING AGENCIES AND INVESTIGATORS: Dr. D. Evans
Department of Environmental Studies
Trent University

DURATION OF EACH PHASE: Evaluated yearly

APPROXIMATE COST: $30K/year

OBJECTIVES: To determine the rates of accumulation of substances (metals, nutrients) in lake sediments. To reconstruct deposition rates in the lakes.

METHOD: The chronologies of sediment cores from multiple sites in each of 10 lakes have been established using ^{210}Pb methodology and the deposition patterns in the lakes investigated.

ANTICIPATED RESULTS: Whole lake accumulation rates of sediments, metals and nutrients will be obtained and related to mass balance measurements. Attempts to construct predictive sedimentation models will follow.

PROJECT NUMBER: 263

SUBJECT CODE: 3.1.5

TITLE: Downcore Relationship Between Fire and Logging Events and Diatom Inferred Lake pH in the Algoma District North of Lake Superior

PRINCIPAL INVESTIGATOR'S NAME: Mike Dickman

AGENCY AND DEPARTMENT: Brock University, Biological Sciences Department

ADDRESS: St. Catharines, Ontario

PHONE: (416) 688-5550 Ext. 392

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: Lake coring to commence during the summer of 1983 and core analyses to follow over the next two years.

APPROXIMATE COST: $3.0K per core - with a maximum of 12 cores over 3 years.

OBJECTIVES: To determine whether a fire or logging event is consistently followed by an increase in pH as inferred from a shift toward more alkalophilous and less acidophilous diatom indicator species. These analyses would be made by inferring changes in lake pH down the length of a 20 cm long sediment core removed from the deepest part of a lake in which there was a record of past fire or logging events within the watershed.

METHOD: Autecological studies of diatoms as pH indicators have opened the way to estimating a lake's past pH on the basis of its diatom species composition and relative abundance. Estimating the rate of lake acidification from its sediment subfossil diatoms is possible when these subfossils can be identified and accurately enumerated in the surface sediments of 20 - 30 lakes. Once this is done the diatoms down the length of the sediment core of one or more of these lakes can be enumerated and pH inferred at each depth. This technique holds considerable promise in assessing the temporal impact of acid precipitation for acid-sensitive lakes.

ANTICIPATED RESULTS:

CODE DU SUJET: 3.1.5

NUMÉRO DE PROJET: 264

TITRE: Incidence de l'acidification des eaux et des cours d'eau sur leur teneur en aluminium libre

NOM DU CHERCHEUR RESPONSABLE: Lubomir Zikovsky

MINISTÈRE, ORGANISME OU ORGANISME PRIVÉ, SERVICE: Ecole Polytechnique de Montréal

ADRESSE: Case Postale 6079, Succursale "A"
Montréal, Québec
H3C 3A7

TÉLÉPHONE: (514) 344-4706

COLLABORATEUR(S), ORGANISME(S) ET CHERCHEUR(S): Jean-Louis Galinier
Ecole Polytechnique de Montréal

DURÉE DE CHAQUE PHASE: 1 an

COÛT APPROXIMATIF: $8,000

OBJECTIFS DE TRAVAIL: Mesurer les taux de lixiviation de l'aluminium par l'eau acidifiée à partir des sols et sédiments.

MÉTHODE DE TRAVAIL: Etude expérimentale en laboratoire. Dosage d'aluminium par activation neutronique. Séparation de l'aluminium.

RÉSULTATS PRÉVUS: Détermination du taux et de la cinétique de lixiviation. Effet du pH sur la lixiviation.

NUMÉRO DE PROJET: 265

CODE DU SUJET: 3.1.5

TITRE: Effets de l'acidification sur les communautés benthiques et rôle tampon des sédiments

NOM DU CHERCHEUR RESPONSABLE: J. B. Serodes

MINISTÈRE, ORGANISME OU ORGANISME PRIVÉ, SERVICE: Centre de recherches sur l'eau

ADRESSE: Université Laval
Pavillon Pouliot, Québec
G1K 7P4

TÉLÉPHONE: (418) 656-2868

COLLABORATEUR(S), ORGANISME(S) ET CHERCHEUR(S): G. Moreau, Dept. Biologie, U. Laval
M. Allard, " " "

DURÉE DE CHAQUE PHASE: 3 ans

COÛT APPROXIMATIF: $15,000/an

OBJECTIFS DE TRAVAIL:

MÉTHODE DE TRAVAIL: Acidification a divers pH en milieu lotique seminaturel (canaux alimentés naturellement)

RÉSULTATS PRÉVUS: Sensibilité relative des divers types d'organismes benthiques.

SUBJECT CODE: 3.1.5

PROJECT NUMBER: 266

TITLE: A Feasibility Study on the Use of Filamentous Algae as Monitors of Mercury in Acid-Stressed Lakes

PRINCIPAL INVESTIGATOR'S NAME: P. M. Stokes

AGENCY AND DEPARTMENT: Botany Dept. & Institute for Environmental Studies

ADDRESS: University of Toronto
Toronto, Ontario
M5S 1A4

PHONE: (416) 978-6526

COOPERATING AGENCIES AND INVESTIGATORS: Funded by NRC

DURATION OF EACH PHASE: 12 months

APPROXIMATE COST: $25,000

OBJECTIVES: To determine for lakes ranging in pH from 7.0 - 4.5 the bioaccumulation of mercury in attached algae, and to evaluate their use as monitors of available mercury in acid stressed lakes.

METHOD:
1) Collection of algae colonizing artificial substrates as well as natural communities, for 2 sampling periods during 1982.
2) Determination of mercury - total (and selected formethyl) for water sediments and biota.
3) Collection of sample for other physical and chemical parameters which may influence metal availability and biological uptake.
4) Comparison with mercury in fish from same lakes.

ANTICIPATED RESULTS: Factors which are related to mercury levels in biota will be determined. In the pattern shown for fish, i.e. negative correlation of mercury with pH and other physical lake variable holds for algae, they may provide fast and inexpensive material for biomonitoring.

PROJECT NUMBER: 267

SUBJECT CODE: 3.1.5

TITLE: Benthic Plant Communities in Acid Lakes: of Lakes of Al and Benthic Faunal Interactions

PRINCIPAL INVESTIGATOR'S NAME: P. M. Stokes

AGENCY AND DEPARTMENT: Institute for Environmental Studies

ADDRESS: University of Toronto
Toronto, Ontario
M5S 1A4

PHONE: (416) 978-6526

COOPERATING AGENCIES AND INVESTIGATORS: N. Collins, J. C. Van Loon
Funded by NSERC (Strategic)

DURATION OF EACH PHASE: 3 Years

APPROXIMATE COST: $35,000 (annually) 1982-85

OBJECTIVES: To determine the relationship between benthic plant biomass and distribution and benthic fauna, related to pH and Al in water and sediments. To relate this to the oligotrophication hypothesis.

METHOD: Field survey followed by enclosure experiments.
SCUBA divers carry out field survey.
Multivariate statistical analysis.
Speciation analysis.

ANTICIPATED RESULTS:

1. Community structure of benthic plants and animals related to environmental gradients especially pH, alkalinity and Al.
2. Predictive model of relationship between lake acidification, or neutralization, and benthic community response.

SUBJECT CODE: 3.1.5

PROJECT NUMBER: 268

TITLE: Records of Acidification in Ontario Lake Sediments

PRINCIPAL INVESTIGATOR'S NAME: Dr. G. L. Vascotto (acting)

AGENCY AND DEPARTMENT: Ontario Hydro

ADDRESS: Biological Research Section
800 Kipling Avenue, KD118
Toronto, Ontario
M8Z 5S4

PHONE: (416) 231-4111
Ext. 6865

COOPERATING AGENCIES AND INVESTIGATORS:
Dr. N. M. Hooper-Reid
Ms. J. K. Kwik (Ontario Hydro)
Dr. G. L. Vascotto

DURATION OF EACH PHASE: Phase I - Complete September 1982
Phase II - May 1984

APPROXIMATE COST: Phase II - $125,000

OBJECTIVES: Determine if Ontario lakes currently having low pH have undergone rapid acidification in the last century.

METHOD:
1. Develop sets of acid sensitive inference system based on diatoms, cladocerans and aquatic dipterans.
2. Using diatom and dipteran remains in lake sediments determine if low pH lakes in Ontario have undergone rapid acidification in recent times.

ANTICIPATED RESULTS: A clearer understanding of recent acid rain impact on pH changes of sensitive watersheds.

PROJECT NUMBER: 269

SUBJECT CODE: 3.1.5

TITLE: Analyses of Lake Sediment Chemistry in Northeastern Ontario

PRINCIPAL INVESTIGATOR'S NAME: J. R. Morris

AGENCY AND DEPARTMENT: Department of Biology

ADDRESS: Laurentian University
Ramsey Lake Road
Sudbury, Ontario
P3E 2C6

PHONE:

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: 1982-85

APPROXIMATE COST:

OBJECTIVES: To survey and assess the ecological significance of chemical profiles in sediment cores from lakes in northern Ontario, especially parameters related to, or greatly influenced by, pH.

METHOD: Sediment cores from about 100 lakes will be collected and analyzed. We will attempt to understand the variability observed within and among lakes using such data. Also, the data will be interpreted, to the extent possible, in relation to the ecology of the micro-environments at the sediment-water interface.

To date, samples have been obtained from about 50 lakes, and some analyses have been completed (pH and electrode potentials).

ANTICIPATED RESULTS:

SUBJECT CODE: 3.1.5

PROJECT NUMBER: 270

TITLE: Microbiological and Chemical Equilibria in Acid Stressed Soils

PRINCIPAL INVESTIGATOR'S NAME: Dr. V. J. Sharpe

AGENCY AND DEPARTMENT: Ontario Hydro

ADDRESS: Biological Research Section, KD120
800 Kipling Avenue
Toronto, Ontario
M8Z 5S4

PHONE: (416) 231-4111
Ext. 6096

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: Phase I 1981-82
Phase II 1982-83

APPROXIMATE COST: Phase I - $68K Phase II - $40K

OBJECTIVES: To derive a relationship between the fate of acid rain components and microbial community dynamics in a terrestrial system.

METHOD: Phase I - Sterile and non-sterile soil columns were dosed with synthetic acid rain. Periodically soil samples were removed from different soil depths and analyzed for a range of bacteria involved in the C, S and N cycles. Soil column leachate was analyzed for major cations and anions.

Phase II - On the basis of methods developed, and results obtained, in Phase I, a similar experimental system will be employed using a range of different soil types.

ANTICIPATED RESULTS: Phase I and II - To derive information on the importance of bacteria in the S and N cycles with respect to the modification of acid rain components in lake watershed systems.

PROJECT NUMBER: 271

SUBJECT CODE: 3.1.5

TITLE: Sediments as Indicators of Acidification History

PRINCIPAL INVESTIGATOR'S NAME: Dr. S. Ray

AGENCY AND DEPARTMENT: Department of Fisheries and Oceans

ADDRESS: Biological Station
St. Andrews, New Brunswick
EOG 2X0

PHONE: (506) 529-8854

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: 3 Years

APPROXIMATE COST: $10K

OBJECTIVES: To determine feasibility of using trace elements and algal deposits in sediments as an indicator of acidification history and its application in the Westfield study area.

METHOD: Sediment cores will be analyzed for trace metals and algal deposits. Leaching of trace metals will be studied in model experiments in the laboratory. Sediment cores 1 m long by 5 cm diam. will be divided into 1 cm horizons for examination. By making a stratigraphic study of the many species of diatoms in each horizon, changes in pH of the water column can be identified on the basis of specific pH preference. The vertical profile for the diatoms together with the knowledge of their pH preferences should give the history of acidification off the core samples. At the same time Pb-210 dating of the core horizons will provide sedimentation rate in the lake. The change in trace metal contents and the diatom profile, together with the age of the sediment horizons, may be a suitable indication of acidification history of the lakes.

ANTICIPATED RESULTS: Information on historical pH levels in the lakes studied.

SUBJECT CODE: 3.1.5

PROJECT NUMBER: 272

TITLE: Limnologist, Associate Professor

PRINCIPAL INVESTIGATOR'S NAME: Mike Dickman

AGENCY AND DEPARTMENT: Biological Sciences Department

ADDRESS: Brock University
St. Catharines, Ontario
L2S 3A1

PHONE: (416) 688-5550
Ext. 392

COOPERATING AGENCIES AND INVESTIGATORS: Ontario Ministry of Natural Resources
Geological Survey Branch

DURATION OF EACH PHASE:
Phase I 1980-81 - Acid Rain Regional Survey of Lakes north of Lake Superior
Phase II 1981-82 - Staircase Lakes Study
Phase III 1982-83 - Verification & Confirmation

APPROXIMATE COST:
Phase I - $13,000
Phase II - $21,000
Phase III - $27,000

OBJECTIVES: To determine the rate of lake acidification using lake sediment diatoms. Shifts in acid indicator species composition over time in cores from these lakes permit estimates of the rate of lake acidification.

METHOD: Each lake is cored, the core is sectioned at 0.5 cm intervals and the sediment influx rates determined using Lead-210, Cesium-137 and *Ambrosia* rise pollen data. The ratio of acid loving diatoms to circumneutral diatoms is calculated at each depth. These data are used to calculate the diatom inferred pH at each depth.

ANTICIPATED RESULTS: 1980-81 results have been published by the Ontario Geological Survey open file Report #5342 Volumes I (122 pp) & Vol II (237 pp).

PROJECT NUMBER: 273

SUBJECT CODE: 3.1.5

TITLE: The Effects of Acidification on Bacterial Methane Production in Hypolimnetic Lake Sediments

PRINCIPAL INVESTIGATOR'S NAME: S. G. Lawrence

AGENCY AND DEPARTMENT: Department of Fisheries and Oceans

ADDRESS: Freshwater Institute
501 University Crescent
Winnipeg, Manitoba
R3T 2N6

PHONE: (204) 269-7379

COOPERATING AGENCIES AND INVESTIGATORS: Gregor M. Awang (Graduate Student)
Department of Microbiology
University of Manitoba

DURATION OF EACH PHASE: 1980-1983

APPROXIMATE COST: 1980: $3,000, 1981-82: $8,000/yr; 1983: $4,000

OBJECTIVES: To determine which of three or more stages in the bacterial fermentation of organic carbon to methane and carbon dioxide are sensitive to acidification.

METHOD:

a) Determine input of particulate organic carbon to the lake hypolimnion and output of methane and CO_2 to the water column.

b) Determine critical inhibitory pH of methane production on sediment cores incubated at lake sediment temperatures.

c) Use labelled carbon compounds (e.g. particulate organic carbon, sodium acetate) to determine changes in rates of methane and carbon dioxide production and in the methane to carbon dioxide ratio at various pH regimes in enrichment cultures and in methanogenic sediments.

ANTICIPATED RESULTS: Thesis delineating effects of lowered pH on the metabolism of several bacterial groups which are active in the various stages of the fermentation of organic carbon to methane and carbon dioxide. More contributions to the primary literature.

SUBJECT CODE: 3.1.5

PROJECT NUMBER: 274

TITLE: Sedimentary Diatom Analyses for the Evaluation of the Effects of Acid Precipitation on Dilute Lakes

PRINCIPAL INVESTIGATOR'S NAME: H. C. Duthie and S. M. Smith

AGENCY AND DEPARTMENT: Department of Biology, University of Waterloo

ADDRESS: Waterloo, Ontario
N2L 3G1

PHONE: (519) 885-1211
Ext. 3224

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: 3 years, starting Spring 1983

APPROXIMATE COST: $30K+

OBJECTIVES: Calibration of sedimentary diatom analyses for evaluating the effects of acid precipitation on dilute lakes. The research addresses the problem of refining diatom technology in order to quantify historical changes in lake pH, thus providing a perspective upon which remedial measures may be based.

METHOD: Surficial sediment samples for quantitative diatom analysis will be collected from 50-100 acid-sensitive lakes on the Canadian Shield and water samples will be collected for pH and other analyses. The data will be subjected to stepwise multiple-regression analysis, principal-components analysis, and categorical analysis. In this way we should be able to define the pH preferences of many diatom species. The information will be used to interpret the historical changes in lake pH for which down-the-core diatom analyses already exist.

ANTICIPATED RESULTS:

PROJECT NUMBER: 275

SUBJECT CODE: 3.1.6

TITLE: Invertebrates of the Westfield River Study Area and their Relationship to the Food Habits of the Fish

PRINCIPAL INVESTIGATOR'S NAME: M. J. Dadswell

AGENCY AND DEPARTMENT: Department of Fisheries and Oceans

ADDRESS: Biological Station
St. Andrews, New Brunswick
EOG 2X0

PHONE: (506) 529-8854

COOPERATING AGENCIES AND INVESTIGATORS: Aquatic Industries Limited
(Mr. Derek Knox, Ms. Leslie Linkletter)

DURATION OF EACH PHASE: 3 years

APPROXIMATE COST: $42K

OBJECTIVES: Determine species composition, seasonal and spatial distribution, and abundance of benthic invertebrates in and on the substrate and in the drift of the Westfield study area. Quantitatively examine fish stomachs and invertebrates to determine fish food habits and their relation to each component of available food.

METHOD:

1. Survey study area using hand collecting, Surber samplers and pot samplers to determine total species composition of invertebrates and map their distribution within the study area. This general collecting will be done four times, once each in June, August, October and March.

2. Quantitatively sample benthic, drift and emergent invertebrates using Coleman-Hynes pot samplers drift nets and emergence traps. Replicate pot samples (2) are to be obtained from 12 sites along 4 transects within the study area once monthly, May to December, and in March (9 sample times). Drift nets are to be set on 2 transects during a 3-day period and sampled on a diurnal basis (sample removed in early morning and early evening). Emergence traps (4) will be placed at each transect on a weekly basis May-December and in March to collect emergent insects. Samples are to be sorted, enumerated to required taxonomic level (genus), and dry weights obtained.

3. Fish stomachs provided by Dr. R. H. Peterson will be analyzed as to taxonomic composition, numbers of individuals and total dry weights.

ANTICIPATED RESULTS: Maps of species distribution in study area, species list in study area, catalogue of fish food items, estimate of invertebrate productivity and flux through the study area.

SUBJECT CODE: 3.1.6

PROJECT NUMBER: 276

TITLE: Field Studies on Aquatic Macrophytes, Amphibians and Stemflow and Thoroughfall Chemistry

PRINCIPAL INVESTIGATOR'S NAME: Bill Freedman

AGENCY AND DEPARTMENT: Dept. of Biology and Institute for Resource & Environmental Studies

ADDRESS: Dalhousie University
Halifax, Nova Scotia
B3H 4J1

PHONE: (902) 424-3829

COOPERATING AGENCIES AND INVESTIGATORS: Canadian Forestry Service, Canadian Wildlife Service

DURATION OF EACH PHASE: 3 - 4 years

APPROXIMATE COST: 1. ca. $12,000/yr 2. ca. $10,000/yr 3. ca. $20,000/yr

OBJECTIVES:

1. Effects of acidity on reproduction of Nova Scotia amphibians (CWS).
2. Aquatic macrophytes in lakes of various acidities (CWS).
3. Stemflow and thoroughfall chemistry in various forest types (CFS).

METHOD:

1. Field surveys for habitat characteristics, lab bioassays for pH effects.
2. Field surveys of various lakes.
3. Fieldwork in various forest stands.

ANTICIPATED RESULTS:

PROJECT NUMBER: 277

SUBJECT CODE: 3.1.6

TITLE: Acidification of a Thermally-mixed Lake, Lake 114, by Addition of Sulfuric Acid

PRINCIPAL INVESTIGATOR'S NAME: D. W. Schindler

AGENCY AND DEPARTMENT: Fisheries and Oceans, Freshwater Institute

ADDRESS: Experimental Lakes Area
P.O. Box 313
Kenora, Ontario

PHONE: (807) 227-5414

COOPERATING AGENCIES AND INVESTIGATORS: Lamont-Doherty Geological Observatory
University of Winnipeg

DURATION OF EACH PHASE: 1979 - 1984

APPROXIMATE COST:

OBJECTIVES: To test the rate of acidification of an extremely acid-susceptible lake under a "realistic" acid addition scheme.

METHOD:

1. Enough H_2SO_4 is added to Lake 114 monthly to simulate lowering the pH of the precipitation on the lake surface from the current 5.0 to 4.0.

2. Tests specific to this experiment include: a) role of epilimnion sediments in sulfate reduction/alkalinity generation using both direct microbial radio-bioassays and indirect mass-balance techniques. b) detailed work on embryological and physiological indicators of acid stress in Pimephales, which proved to be extremely sensitive in Lake 223, c) detailed work on the microbial and geo-chemical interactions between epilimnetic sediments and overlying waters as affected by acidification.

3. Impact of acidification on many other parameters as well is being studied, physical parameters, chemical budgets, primary production, and algal zooplankton, fish and benthic communities.

4. The lake may be used as a site for an acid-aluminum "pulse" experiment.

ANTICIPATED RESULTS: Efficiency of known acid additions to produce acidification in a thermally-mixed, well-oxygenated lake.

SUBJECT CODE: 3.1.6

PROJECT NUMBER: 278

TITLE: Experimental Acidification of a Thermally-stratified Lake, Lake 223, by the Addition of Sulfuric Acid

PRINCIPAL INVESTIGATOR'S NAME: D. W. Schindler

AGENCY AND DEPARTMENT: Department of Fisheries and Oceans

ADDRESS: Freshwater Institute
501 University Crescent
Winnipeg, Manitoba
R3T 2N6

PHONE: (204) 269-7379

COOPERATING AGENCIES AND INVESTIGATORS:
Lamont-Doherty Geological Observatory (trace metals and radionuclides)
University of Winnipeg (Microbiology)
University of Manitoba (Microbiology)
University of Kansas (Ecotoxicology)

DURATION OF EACH PHASE:
a) pre-acidification 1974-1975
b) phase I - acidification 1976-1983
c) phase II - acidification + (metal or nutrient) or amelioration 1984

APPROXIMATE COST:

OBJECTIVES:
1. To obtain quantitative mass-balance budgets for the hydrogen ion, sulfate, trace metals and nutrients in order to discern acid-induced changes in biogeochemical cycles.
2. To determine changes in plant and animal communities early in the acidification process.

METHOD:
1. Lake 223 has been progressively acidified with H_2SO_4 in order to reduce epilimnetic pH by approximately 0.25 units per year.
2. Detailed hydrology and chemistry allow precise estimation of effects of acidification on lake metabolism.
3. Detailed ecological, physiological and/or embryological studies on lake trout, white sucker, crayfish, *Mysis relicta*, and benthic insects.
4. Other parameters, physical, other chemical budgets, primary production, algal, zooplankton, other fish and crayfish and benthic communities are being studied.
5. Phase II will consider several options, a) acidification to pH 5.0, b) acid-aluminum combinations, c) acid and nutrient additions, d) material recovery, e) amelioration.

ANTICIPATED RESULTS:
1. Prediction of rates of lake acidification under known acid inputs.
2. Further assessment of the changes in productivity and nutrient cycles with acidification.
3. Experimental results could influence design of a "monitoring" program to assess the biological vulnerability of lakes by focussing on the organisms lost early in the acidification process.

PROJECT NUMBER: 279

SUBJECT CODE: 3.1.6

TITLE: Relative Acidifying Effects of Sulfuric Acid and Nutric Acid Added to a Whole Lake, Lake 302

PRINCIPAL INVESTIGATOR'S NAME: D. W. Schindler

AGENCY AND DEPARTMENT: Department of Fisheries and Oceans

ADDRESS: Experimental Lakes Area
P.O. Box 313
Kenora, Ontario

PHONE: (807) 227-5414

COOPERATING AGENCIES AND INVESTIGATORS:
Lamont-Doherty Geological Observatory (trace metals and radionuclides)
University of Winnipeg (microbiology)
University of Manitoba (Botany)
University of Kansas (Ecotoxicology)

DURATION OF EACH PHASE:
1981 background year
1982-1986 experimental period

APPROXIMATE COST:

OBJECTIVES: To compare the potential for acidification of lakes of addition of H_2SO_4 and HNO_3.

METHOD:

1. Lake 302 was divided into halves with a vinyl curtain, a technique used frequently at ELA in the past.
2. One basin is acidified with H_2SO_4, the other with HNO_3.
3. Most emphasis is on a) modification of microbial metabolism of sulfur, nitrogen, carbon and methylated metals by acidification, b) effects of acidification on periphyton and on benthic algal communities, c) mobilization of uranium and thorium-series elements from sediments.
4. Routine sampling of conductivity, alkalinity, water chemistry, primary production, algal and zooplankton biomass and community structure, benthic insect community, crayfish, and fish.

ANTICIPATED RESULTS: The result should serve as a preliminary index of the relative importance of SO_x vs NO_x control.

SUBJECT CODE: 3.1.6

PROJECT NUMBER: 280

TITLE: Physiological Responses of Crayfish to Low pH and to Low pH and Metals; Adaptation by Crustaceans to Acidic Waters

PRINCIPAL INVESTIGATOR'S NAME: D. F. Malley

AGENCY AND DEPARTMENT: Department of Fisheries & Oceans

ADDRESS: Freshwater Institute
501 University Crescent
Winnipeg, Manitoba
R3T 2N6

PHONE: (204) 269-7379

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: 1981-1984

APPROXIMATE COST: 1981-1982: $3,000 1982-1984: each $8,000

OBJECTIVES:

1. To determine significant physiological responses to crayfish from environments of low ionic content to low pH and to metals in the presence of low pH.
2. To understand the physiological adaptations of crustaceans which inhabit water of pH 3.8 to 4.2.

METHOD:

1. Measure effect on uptake of Ca-45 during postmolt to low pH and low pH plus Al, Cd, Zn.
2. Measure the relationship between whole body permeability measured with tritiated water and the tolerance to low pH measured by mortality experiments and by the response of ionic uptake in low pH.
3. Measure the bioaccumulation of several metals, Al, Zn, Se, Hg, Cd by crayfish under several conditions of pH and Ca^{++} content of the water.

ANTICIPATED RESULTS: Enhanced understanding of the impact of acid precipitation on aquatic crustaceans and of the physiological basis of differences in tolerance to acid.

PROJECT NUMBER: 281

SUBJECT CODE: 3.1.6

TITLE: Effects of LRTAP and Acidic Precipitation on Amphibian Distribution and Reproductive Activity Southwest of Sudbury

PRINCIPAL INVESTIGATOR'S NAME: V. Glooschenko

AGENCY AND DEPARTMENT: Ministry of Natural Resources, Wildlife Branch

ADDRESS: Whitney Block, Queen's Park
Toronto, Ontario
M7A 1W3

PHONE: (416) 965-7641

COOPERATING AGENCIES AND INVESTIGATORS:

Mr. Wayne Weller
Proctor and Redfern Ltd.
75 Eglinton Avenue East
Toronto, Ontario
M4P 1H3

Mr. Nabil Arafat
Ecological Impact Section
Aquatic Ecology Division
National Water Research Instit.
Burlington, Ontario
L7R 4A6

DURATION OF EACH PHASE:

A) Field data including presence, reproductive activity of amphibians, substrate, water chemistry variables, vegetation (species composition, abundance) May-July '82

B) Analyses of some amphibians, vegetation for heavy metals Sept.-Oct. '82

APPROXIMATE COST: $9.0K

OBJECTIVES: To correlate amphibian presence and reproductive activity with environmental variables along a pH gradient southwest of Sudbury.

METHOD: Searching for amphibians in at least 4 habitat types (wood land pond, lake shoreline, streams and forests) using standard techniques.

Description of habitat type with soil, water and vegetation parameters including appropriate physical and chemical variables.

Heavy metal analyses of selected biota.

ANTICIPATED RESULTS:

A) Documentation of specific amphibian breeding activity in the Sudbury area.

B) Correlation of distribution, reproduction with recorded or analysed environmental variables including heavy metal concentration and pH.

CODE DU SUJET: 3.1.6

NUMÉRO DE PROJET: 282

TITRE: Composition des communautés d'oiseaux lacustres de lacs et de terres humides à acidité variable au Québec

NOM DU CHERCHEUR RESPONSABLE: M. Jean-Luc DesGranges

MINISTÈRE, ORGANISME OU ORGANISME PRIVE, SERVICE: Environnement Canada, Service canadien de la faune (SCF)

ADRESSE: 2700 Boulevard Laurier
C.P. 10100
Ste-Foy, Québec
G1V 4H5

TÉLÉPHONE: (418) 694-3914

COLLABORATEUR(S), ORGANISME(S) ET CHERCHEUR(S): MM. Benoit Houde et Marcel Darveau (SCF)
Service de qualité des eaux,
Environnement Québec

DURÉE DE CHAQUE PHASE:

a) Planification: du 80/01 au 80/05
b) Collecte et analyse des données: du 80/05 au 83/03
c) Rédaction: du 83/04 au 84/04

COÛT APPROXIMATIF: Du 80/01 au 84/04: $350K

OBJECTIFS DE TRAVAIL: Déterminer si les changements dans les populations d'animaux aquatiques et les modifications dans la végétation aquatique et ripicole qu'entraîne l'acidification des lacs affectent les oiseaux lacustres.

MÉTHODE DE TRAVAIL: Étude détaillée de la sélection de l'habitat par les espèces qui fréquentent des lacs de différents pH dans chacun des biomes du Québec.

RÉSULTATS PRÉVUS: Une fois les niches écologiques caractérisées pour chacune des espèces d'oiseaux fréquentant des milieux aquatiques distribués le long d'un gradient d'acidité, nous serons à même, à partir des données écologiques recueillies, de prévoir les effets à long terme des précipitations acides sur les communautés d'oiseaux lacustres.

NUMÉRO DE PROJET: 283

CODE DU SUJET: 3.1.6

TITRE: Écologie de trois espèces d'oiseaux lacustres particulièrement sensibles à l'acidité des lacs

NOM DU CHERCHEUR RESPONSABLE: M. Jean-Luc DesGranges

MINISTÈRE, ORGANISME OU ORGANISME PRIVÉ, SERVICE: Environnement Canada, Service canadien de la faune

ADRESSE: 2700 Boulevard Laurier
C.P. 10100
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G1V 4H5

TÉLÉPHONE: (418) 694-3914

COLLABORATEUR(S), ORGANISME(S) ET CHERCHEUR(S): MM. Benoit Houde et Marcel Darveau (SCF)
Autres collaborations: à déterminer

DURÉE DE CHAQUE PHASE:

a) Planification et préparation de l'étude: du 83/03 au 85/03
b) Collecte et analyse des données: du 85/04 au 87/03
c) Rédaction: 87/04 au 88/04

COÛT APPROXIMATIF: Du 83/03 au 88/04: $300K

OBJECTIFS DE TRAVAIL: Déterminer comment l'acidité de certains milieux lacustres affecte l'alimentation et la reproduction de trois espèces particulièrement sensibles à l'acidité de leur milieu. Chacune de ces espèces sera choisie en fonction de son régime alimentaire particulier (poissons, invertébrés aquatiques, insectes émergents).

MÉTHODE DE TRAVAIL: Les données que nous comptons recueillir concerneront entre autres: (1) la distribution des individus selon l'acidité des habitats, (2) la contamination des œufs et le succès de reproduction des différents couples, (3) la croissance des jeunes, (4) les types de nourriture recherchés et les succès de capture selon la disponibilité des proies, (5) la toxicité de la nourriture et le degré d'intoxication des jeunes et des adultes, (6) le bilan temporel et énergitique, etc.

RÉSULTATS PRÉVUS: Identification des mécanismes écologiques et physiologiques qui font que certains groupes d'oiseaux lacustres sont affectés par le niveau d'acidité des lacs et des terres humides qu'ils fréquentent à la période de nidification.

SUBJECT CODE: 3.1.6

PROJECT NUMBER: 284

TITLE: Paleolimnology of Acid Susceptible Lakes

PRINCIPAL INVESTIGATOR'S NAME: L. D. Delorme

AGENCY AND DEPARTMENT: DOE/NWRI/AED

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Canada Centre for Inland Waters
867 Lakeshore Road, P.O. Box 5050
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L7R 4A6

PHONE: (416) 637-4317
-4554

COOPERATING AGENCIES AND INVESTIGATORS: Dr. S. R. Esterby (NWRI)
Dr. H. Duthie (University of Waterloo)

DURATION OF EACH PHASE: Final year

APPROXIMATE COST: $6K

OBJECTIVES: To assess whether or not a given lake is naturally acidic or whether the acidity has come predominantly from anthropogenic sources.

METHOD: To delineate within a time framework of the last 200 years, the changes in hydrogen ion concentration, within a given lake, using fossils particularly diatoms. This is done by determining the alpha index (Nygaard) and then using the Del Pocte or Norton model to predict the past pH.

ANTICIPATED RESULTS: Final report and manuscript to be completed during 1983-84.

PROJECT NUMBER: 285

SUBJECT CODE: 3.1.6

TITLE: Investigation of the Effects of the Acidification of Breeding Habitats on Amphibians in Nova Scotia

PRINCIPAL INVESTIGATOR'S NAME: J. J. Kerekes

AGENCY AND DEPARTMENT: Environment Canada, Canadian Wildlife Service, Atlantic Reg.

ADDRESS: c/o Biology Department
Dalhousie University
Halifax, Nova Scotia
B3H 4J1

PHONE: (902) 426-6356

COOPERATING AGENCIES AND INVESTIGATORS: Dr. B. Freedman
Biology Department
Dalhousie University
Halifax, Nova Scotia

DURATION OF EACH PHASE: 1982 field surveys, setting up laboratory experiments
1983 dose-response experiments
1984 final reporting

APPROXIMATE COST: 1983-84 $20K

OBJECTIVES: Determine the potential impacts of habitat acidification on the breeding success of winter species of amphibians that are found in Nova Scotia including Kejimkujik National Park. In laboratory experiments determine the hatching success of larval development of selected species at various pH and aluminum concentrations.

METHOD: Field work includes an extensive survey of breeding sites; where the presence of amphibian species will be documented in relation to water quality. At least 125 sites will be surveyed including Kejimkujik National Park. Laboratory work will examine the hatching success and larval development in waters experimentally altered to produce a range of pH (3 to 8) a range of aluminum concentration and a range of dissolved organic content (one colored dystrophic, one clearwater type; these waters are from Kejimkujik lakes). Test species will include yellow-spotted Salamander, wood frog, spring peeper. The effects of chemical treatments will be assayed in terms of egg mortality, developmental abnormalities in the larvae, including skeletal development.

ANTICIPATED RESULTS: Progress report, March, 1983.
Final report, March 1984.
M.Sc. thesis, Dalhousie University 1984 (J. Dale)
Publication on breeding distribution on amphibians in Nova Scotia, in 1984.
Publication(s) on the effect of pH on the embryonic development of selected amphibian species, in 1984.

SUBJECT CODE: 3.1.6

PROJECT NUMBER: 286

TITLE: Macroinvertebrate Community Assessment in Three Lakes in Kejimkujik National Park, Nova Scotia

PRINCIPAL INVESTIGATOR'S NAME: J. Kerekes

AGENCY AND DEPARTMENT: Environment Canada, Canadian Wildlife Service, Altantic Reg.

ADDRESS: c/o Biology Department
Dalhousie University
Halifax, Nova Scotia
B3H 4J1

Phone: (902) 426-6356

COOPERATING AGENCIES AND INVESTIGATORS: Contract

DURATION OF EACH PHASE: Preliminary study conducted in 1980. Quantitative study and report in 1983 - 1984.

APPROXIMATE COST: $23K (B-base)

OBJECTIVES: Identify and describe macroinvertebrate populations, estimate their abundance and productivity in three Kejimkujik watershed study lakes.

METHOD: Quantitative samples of macroinvertebrates will be collected along transects (to coincide with those of the macrophyte study) in each of the three lakes (at intervals to be determined) from May until October. This includes benthic samples (and replicates) in open water and macrophyte beds. Specimens will be identified, enumerated and weights recorded along a number of transects in the three study lakes already set out for the macrophyte research.

ANTICIPATED RESULTS: Report of species composition, abundance and response to water chemistry differences in the Kejimkujik study lakes.

PROJECT NUMBER: 287

SUBJECT CODE: 3.1.6

TITLE: Ecology of Selected Species of Lacustrine Birds Particularly Sensitive to Acidity in Lakes

PRINCIPAL INVESTIGATOR'S NAME: Mr. Jean-Luc DesGranges CWS Québec
Mr. K. Ross CWS Ontario
Mr. D. McNicol CWS Ontario

AGENCY AND DEPARTMENT: Environment Canada, Canadian Wildlife Services (CWS)

ADDRESS: 2700, Boul. Laurier
P.O. Box 10100
Ste-Foy, Québec
G1V 4H5

1725 Woodward Drive
Ottawa, Ontario

PHONE: (418) 694-3914

COOPERATING AGENCIES AND INVESTIGATORS: Mr. Benoit Houde and Mr. Marcel Darveau (CWS)
Contractors: to be determined

DURATION OF EACH PHASE:
(a) Planning and preparation of study: from 83/03 to 85/03
(b) Collecting and analysing data: from 85/04 to 87/03
(c) Writing: from 87/04 to 88/04

APPROXIMATE COST:

OBJECTIVES: To determine how the acidity of certain lake environments affects the feeding and reproduction of three species particularly sensitive to the acidity in their environment. Each of these species will be chosen on the basis of its particular diet (fish, aquatic invertebrates, emergent insects).

METHOD: The data collection will concern, among other things:

(1) the distribution of individuals according to the acidity of habitats,
(2) the reproduction of various species,
(3) the growth of young,
(4) the types of food sought and the catch rate according to the availability of prey,
(5) the contamination of food and the potential for accumulation through the food chain,
(6) the bioenergetic requirements of breeding adults and developing young.

ANTICIPATED RESULTS: Identification of the ecological and physiological mechanisms whereby certain groups of lacustrine birds are affected by the level of acidity of the lakes and wetlands that they use during nesting.

SUBJECT CODE: 3.1.6

PROJECT NUMBER: 288

TITLE: Composition of Lacustrine Bird Communities in Quebec Lakes and Wetlands of Variable Acidity

PRINCIPAL INVESTIGATOR'S NAME: Mr. Jean-Luc Des Granges

AGENCY AND DEPARTMENT: Environment Canada, Canadian Wildlife Service (CWS)

ADDRESS: 2700, Boulevard Laurier
P.O. Box 10100
Ste-Foy, Quebec
G1V 4H5

PHONE: (418) 694-3914

COOPERATING AGENCIES AND INVESTIGATORS: Mr. Benoit Houde and Mr. Marcel Darveau (CWS)
Water Quality Service
Environment Québec

DURATION OF EACH PHASE:
(a) Planning: from 80/01 to 80/05
(b) Collecting and analysing data: from 80/05 to 83/03
(c) Writing: from 83/04 to 84/04

APPROXIMATE COST: 1983 - 1984 $20,000, Total 1980 to 1984: $300,000

OBJECTIVES: To determine whether the biological and chemical changes from increased acidity in lakes affect lacustrine birds and their habitat.

METHOD: Detailed study of habitat selection by species which live in lakes with different pH levels in each of Quebec's biomes.

ANTICIPATED RESULTS: Once the characteristics of the biotopes for each species of bird living in aquatic environments distributed along an acidity gradient have been determined, we will be able to use the ecological data collected to predict the long-term effects of acid rain on lacustrine bird communities.

PROJECT NUMBER: 289

SUBJECT CODE: 3.1.6

TITLE: The Role of Microbial Nitrate Reduction in Modifying pH Reduction in a Lake Being Experimentally Acidified by Addition of HNO_3

PRINCIPAL INVESTIGATOR'S NAME: Dr. John W. M. Rudd

AGENCY AND DEPARTMENT: Department of Fisheries and Oceans

ADDRESS: Freshwater Institute
501 University Crescent
Winnipeg, Manitoba
R3T 2N6

PHONE: (204) 269-7379

COOPERATING AGENCIES AND INVESTIGATORS: N. Loewen
University of Manitoba

DURATION OF EACH PHASE: April 1, 1981 to March 31, 1986

APPROXIMATE COST: $30,000

OBJECTIVES: To determine the importance of alkalinity production by microbial nitrate reducing activities in lakes. These include photosynthetic nitrate reduction and bacterial denitrification which both contribute to alkalinity.

To determine the factors controlling rates of denitrification in lakes.

To determine the effects of reduced pH and increased NO_3^- and HS^- concentrations on denitrifying bacteria.

To determine the effects of reduced pH and elevated NO_3^- and NH_4^+ concentrations on rates of N_2O production.

METHOD: Denitrification rates will be assayed by a 15N technique using a mass spectrometer.

Experiments will be done in intact cores, by laboratory incubations of lake sediment and by experiments in large in situ enclosures.

Whole lake denitrification rates will be estimated by mass balance calculation and by isotopic analyses of sedimented organic material.

ANTICIPATED RESULTS: Reduction of nitrate either by bacterial denitrification or by algal photosynthesis results in an increase in alkalinity thus modifying pH reduction resulting from acid precipitation. Bacterial denitrification is a permanent alkalinity increase since N_2 and N_2O produced

SUBJECT CODE: 3.1.6

PROJECT NUMBER: 289 (cont'd)

ANTICIPATED RESULTS: escapes to the atmosphere. Burial of photosynthetically reduced nitrate may not be permanent if the reduced nitrogen is regenerated by microbial decomposition.

The experiments outlined above will be carried out in Lake 302 which is being experimentally acidified by addition of HNO_3. Mass balance calculation will give whole lake nitrate reduction rates. Heavy isotope and bacterial assays of denitrification will be indicative of the relative importance of denitrification vs permanent burial of photosynthetically reduced nitrate. Experiments on pH tolerance and factors controlling rates of denitrification will establish limits for this type of microbial alkalinity producing activity.

PROJECT NUMBER: 290

SUBJECT CODE: 3.1.6

TITLE: Benthos/Littoral Survey in Five Lakes of Various Sensitivities

PRINCIPAL INVESTIGATOR'S NAME: L. W. Maki

AGENCY AND DEPARTMENT: Ontario Ministry of the Environment, Northwestern Region

ADDRESS: 435 James Street South
Thunder Bay, Ontario
P7C 5G6

PHONE: (807) 475-1215

COOPERATING AGENCIES AND INVESTIGATORS:

Dr. K. J. Deacon
Mr. J. Sutton
Dr. G. W. Ozburn

Lakehead University, (Contractor)
Oliver Road
Thunder Bay, Ontario
P7B 5E1
Telephone: (807) 345-2121

DURATION OF EACH PHASE: Open water season, 1982

APPROXIMATE COST: $27K

OBJECTIVES: To determine if any symptoms of acid-stressed benthic and littoral communities exist in five headwater lakes of various sensitivities which receive moderate acidic deposition.

To establish baseline benthic and littoral communities in five lakes, against which future surveys can be compared.

METHOD: Ponar dredges and D-nets were employed to sample the benthic and littoral zones respectively.

ANTICIPATED RESULTS: A final report by April, 1983, is anticipated (subject to review by APIOS members before being released).

SUBJECT CODE: 3.1.6

PROJECT NUMBER: 291

TITLE: Filamentous Algae as Monitor of Metals in Acid Stressed Lakes

PRINCIPAL INVESTIGATOR'S NAME: P. M. Stokes

AGENCY AND DEPARTMENT: Institute for Environmental Studies

ADDRESS: University of Toronto
Toronto, Ontario
M5S 1A4

PHONE: (416) 978-6526

COOPERATING AGENCIES AND INVESTIGATORS: Funded by OME

DURATION OF EACH PHASE: 8 months

APPROXIMATE COST: $14,000

OBJECTIVES: To determine for lakes of varying alkalinity and nutrient status the bioaccumulation of metals (Zn, Ni, Cu, Al, Mn, Cd, Pb) in colonizing filamentous algae found on naturally occurring and artificial substrate.

METHOD: Approximately 35 field sites in Ontario and Quebec will be sampled twice to collect algae, sediment and water for chemical analysis of metals, pH, alkalinity, nutrients, etc.

Multivariate statistical analysis to determine major controlling variables related to metal accumulation.

Comparison of metals in fish and metals in algae.

ANTICIPATED RESULTS: Report on feasibility of using algae as monitors of metals, especially relating this to metals in fish and metal cycling in aquatic systems under acid stress.

PROJECT NUMBER: 292

SUBJECT CODE: 3.2.1

TITLE: Geology and Acid Rain

PRINCIPAL INVESTIGATOR'S NAME: W. W. Shilts, I. M. Kettles

AGENCY AND DEPARTMENT: GSC/EMR

ADDRESS: 601 Booth Street
Ottawa, Ontario
K1A 0E8

PHONE: (613) 995-4523

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: 04/80 - Continuing

APPROXIMATE COST: F.Y. 82-83 O&M $30,700, Sal. $40,000

OBJECTIVES:

1. Map trace metal, texture, $CaCO_3$ variations in glacial drift over a portion of the Canadian Shield; North Bay-Ottawa-Gatineau region.
2. Map thickness and nature of sediment fill in lakes of same region.

METHOD:

1. Samples of till and derived sediments collected from accessible natural and man-made exposures using road network and pipeline excavations as grid. Samples collected below solum.
2. Analyses of 15 trace elements in clay (< 2 um) fraction of till by A.A. and other methods, $CaCO_3$ equivalent by Leco carbon analyzer on < 63 um fraction; texture by pipette.
3. Lake sediment thickness determined using portable low-frequency SONAR equipment mounted on inflatable boat.

ANTICIPATED RESULTS:

1. Map and paper relating terrain sensitivity to mineralogical and chemical properties of glacial deposits. Also relates closely to lake sensitivity.
2. Maps and report showing nature of sediment fill and sediment stratigraphy in lakes. Analyses of cores collected by divers.

SUBJECT CODE: 3.2.1

PROJECT NUMBER: 293

TITLE: Geochemical Data

PRINCIPAL INVESTIGATOR'S NAME: E. H. Hornbrook

AGENCY AND DEPARTMENT: Geological Survey of Canada, Dept. of Energy, Mines and Resources

ADDRESS: 601 Booth Street
Ottawa, Ontario
K1A 0E8

PHONE: (613) 995-4521

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: 1982 Continuing

APPROXIMATE COST: FY 82-83 O&M $200,000, SAL $30,000

OBJECTIVES: To determine the nature of relevant geochemical data that together with available surficial and geological data are required to provide a multi-disciplinary data base for the assessment of environmental problems (natural contamination, man made pollution, acid rain impact) mineral exploration and resource assessment studies.

METHOD: Lake sediment and water survey of a 38,000 square kilometer area of eastern Ontario acid-alkali terrain at a density of one sample per 13 km^2.

ANTICIPATED RESULTS: Element value maps of analytical and physico-chemical measurements will be published followed by interpretive papers and follow-up studies.

PROJECT NUMBER: 294

SUBJECT CODE: 3.2.2

TITLE: Impacts of Air Pollution Mixtures on Forest Vegetation and Soils

PRINCIPAL INVESTIGATOR'S NAME: Mr. B. Munson

AGENCY AND DEPARTMENT: Research Management Division, Alberta Environment

ADDRESS: 14th Floor, Standard Life Centre
10405 Jasper Avenue
Edmonton, Alberta
T5J 3N4

PHONE: (403) 427-3943

COOPERATING AGENCIES AND INVESTIGATORS: Canadian Forestry Service, Environment Canada contracted out to Dr. P. A. Addison, Canadian Forestry Service, 5820 - 122 Street, Edmonton, Alberta T6A 3F5

DURATION OF EACH PHASE: Commenced in 1976

APPROXIMATE COST: $91,854 (82-83)

OBJECTIVES: The study involves both controlled-environment and field research to describe the impact on plant species of a pollution mixture characteristic of Oil Sands operations. It will also develop a predictive capability for changes in forest soils and vegetation at current and predicted rates of pollution deposition in the Oil Sands area.

METHOD: Contact the principal investigator.

ANTICIPATED RESULTS: Annual reports are available from the Research Management Division, Alberta Environment.

SUBJECT CODE: 3.2.2

PROJECT NUMBER: 295

TITLE: Soil pH Program for Sour Gas Industry

PRINCIPAL INVESTIGATOR'S NAME: Mr. David Onuczko

AGENCY AND DEPARTMENT: Air Quality Branch, Pollution Control Division, Alberta Environment

ADDRESS: 6th Floor, Oxbridge Place
9820 - 106 Street
Edmonton, Alberta
T5K 2J6

PHONE: (403) 427-5893

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: Ongoing

APPROXIMATE COST: (0.25 man years - 82-83)

OBJECTIVES: This is a soil pH monitoring program for the sour gas industry in Alberta. Duplicate samples are taken from several sites at varying distances from the monitoring plants. The results are correlated with prevailing wind direction.

METHOD: Contact principal investigator for project procedures.

ANTICIPATED RESULTS: Industry reports and data are available annually from the Pollution Control Division, Alberta Environment.

PROJECT NUMBER: 296

SUBJECT CODE: 3.2.2

TITLE: Sensitivity of Soils in Alberta to Acid Deposition

PRINCIPAL INVESTIGATOR'S NAME: Dr. C. Palmer

AGENCY AND DEPARTMENT: Technical Developments Branch, Earth Sciences Division, Alberta Environment

ADDRESS: P.O. Box 3014
Cousins Buildings
Lethbridge, Alberta
T1J 4C7

PHONE: (403) 229-5322

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: Commenced in 1981

APPROXIMATE COST: $162,000 (82-83)

OBJECTIVES: In an attempt to map soils on the basis of their sensitivity to acidification, the project will investigate (i) whether soil survey information can be used to assess relative sensitivities of soils, (ii) what levels of acid addition can the soils tolerate before their productivity is impaired.

METHOD: Contact principal investigator.

ANTICIPATED RESULTS: Interim results will be available at the end of 1982 from the Earth Sciences Division, Alberta Environment.

SUBJECT CODE: 3.2.2

PROJECT NUMBER: 297

TITLE: Effect of Acidic Precipitation on the Biogeochemistry of Forested Sub-Watersheds

PRINCIPAL INVESTIGATOR'S NAME: W. I. Gizyn, M. A. Griffith
(Supervisor: Dr. S. N. Linzon)

AGENCY AND DEPARTMENT: Ontario Ministry of the Environment, Air Resources Branch, Phytotoxicology Section

ADDRESS: 880 Bay Street, Suite 347
Toronto, Ontario
M5S 1Z8

PHONE: (416) 965-4516

COOPERATING AGENCIES AND INVESTIGATORS:

Contract: University of Toronto, Faculty of Forestry, Toronto, Ontario, Dr. V. Timmer | Ontario Ministry of Natural Resources

DURATION OF EACH PHASE: Program commenced 1982 and scheduled to continue until 1987.

APPROXIMATE COST: $350,000 (1982-83)

OBJECTIVES: To determine the role of precipitation and its chemistry in the element cycling process, and as a source of additional elements and ions to the nutrient and element store of the terrestrial ecosystem.

To determine the role of the terrestrial ecosystem in the process of lake acidification by atmospheric acid deposition.

To determine the rate of biomass, nutrient and trace element accumulation and the rate of recycling.

To determine the present biomass and nutrient and trace element storage.

To describe and map the distribution of forest tree species and soil at two lake sub-watersheds in the Muskoka-Haliburton area of Ontario.

METHOD: Two different forested sub-watersheds are being monitored. Throughfall, stemflow and incident collectors are used to follow element cycling during precipitation events. Litter traps and decomposition bags follow element turnover by means of litter fall. Forest inventory and whole tree harvests are used to establish element store component and annual changes in this store. Soil sampling determines soil pool of elements. Disc lysimeters monitor soil water percolate. This study will be linked to others dealing with ground water and stream water fluxes.

ANTICIPATED RESULTS: Budgets for various elements will be constructed. The role of acidic precipitation in affecting these budgets will be calculated. The role of the forested ecosystem in altering stream water fluxes (chemistry and hydrology) will be described. Differences between coniferous and hardwood forests will be defined.

PROJECT NUMBER: 298

SUBJECT CODE: 3.2.2

TITLE: Effects of Acidic Precipitation and Long Range Transported Pollutants on Terrestrial Ecosystems in Northeastern Ontario

PRINCIPAL INVESTIGATOR'S NAME: Dr. W. D. McIlveen

AGENCY AND DEPARTMENT: Ontario Ministry of the Environment

ADDRESS: 199 Larch Street
Sudbury, Ontario
P3E 5P9

PHONE: (705) 675-4501

COOPERATING AGENCIES AND INVESTIGATORS: Phytotoxicology Section, Air Resources Branch
Ontario Ministry of the Environment
Dr. S. N. Linzon

Northern Terrestrial Consultants, Sudbury
Dr. J. W. Case, Calgary

DURATION OF EACH PHASE: Program commenced 1982 and is scheduled to continue until 1987.

APPROXIMATE COST: $350,000 (1982-83)

OBJECTIVES: To monitor impacts of acidic precipitation and long range transported pollutants on terrestrial ecosystems (soil and vegetation) in Northeastern Ontario.

METHOD:

1. Survey baseline status of soils in Northeastern Ontario.
2. Measuring growth and conditions of commercially important tree seedlings of several locations in Northeastern Ontario.
3. Operation of biogeochemical study of mixed hardwood forest.
4. Evaluation of bryophytes and lichens as biomonitors of acidic precipitation across Ontario.

ANTICIPATED RESULTS:

1. Establishment of reliable data base of soils against which future measurements can be judged.
2. Estimate of economic losses caused by acidic precipitation in Northeastern Ontario.
3. A measure of rates of biogeochemical processes of a hardwood system impacted by acidic precipitation.
4. Data base showing geographical relationships between element content of bryophytes and precipitation quality.

SUBJECT CODE: 3.2.2

PROJECT NUMBER: 299

TITLE: Impact of Acid Deposition on Forest Soils

PRINCIPAL INVESTIGATOR'S NAME: Dr. N. W. Foster

AGENCY AND DEPARTMENT: Department of the Environment, Canadian Forestry Service

ADDRESS: Great Lakes Forest Research Centre
P.O. Box 490
Sault Ste. Marie, Ontario
P6A 5M7

PHONE: (705) 949-9461

COOPERATING AGENCIES AND INVESTIGATORS: NWRI, IWD, DOE, GLBL, DFO, OMNR

DURATION OF EACH PHASE: Setup: 7/80 to 7/81
Operation: 7/81 to at least 7/85

APPROXIMATE COST: $75,000 per annum

OBJECTIVES:

a) to elucidate the influence of atmospheric deposition of acidifying substances upon soil chemical properties and processes.

b) to elucidate the modifying influence of forest soil on properties of percolating acid precipitation.

METHOD: A small catchment with shallow till supporting sugar maple-yellow birch forest was selected for hydrochemical studies which include partitioning the water cycle into precipitation, throughfall, stemflow, forest floor percolate, mineral soil percolate, groundwater and streamflow. Nutrients, major ions, and trace metals will be determined on an "event basis", the work carried out in cooperation with Drs. I. K. Morrison and J. A. Nicolson of GLFRC.

ANTICIPATED RESULTS: A biogeochemical model for an old growth hard maple-yellow birch forest that describes the transport and transformations of elements in the forest ecosystem.

PROJECT NUMBER: 300

SUBJECT CODE: 3.2.2

TITLE: Degeneration Effects of Acid Precipitation on Important Eastern Canadian Forest Soils

PRINCIPAL INVESTIGATOR'S NAME: Dr. G. K. Rutherford

AGENCY AND DEPARTMENT: Department of Geography

ADDRESS: Queen's University
Kingston, Ontario
K7L 3N6

PHONE: (613) 547-2796

COOPERATING AGENCIES AND INVESTIGATORS:

G. Delisle, Department of Microbiology
Queen's University

G. W. Van Loon, Department of Chemistry
Queen's University

Canadian Forestry Service

DURATION OF EACH PHASE: January 1981 to May 1983

APPROXIMATE COST: $100,000 per annum

OBJECTIVES: To study the effects of acid precipitation on the physical, chemical, microbiological and mineralogical properties of soil.

METHOD: Leaching experiments will be carried out, principally in the laboratory, but also in the field at the CFS watersheds at Turkey Lake and Montmorency Forest.

ANTICIPATED RESULTS: An integrated report documenting the effects of accelerated acid loadings on soil properties.

SUBJECT CODE: 3.2.2

PROJECT NUMBER: 301

TITLE: Terrestrial (Soils and Geology) Sensitivity to Acid Precipitation in B.C.

PRINCIPAL INVESTIGATOR'S NAME: John H. Wiens

AGENCY AND DEPARTMENT: B. C. Ministry of Environment/Terrestrial Studies

ADDRESS: 777 Broughton Street
Victoria, B.C.
V8V 1X5

PHONE: (604) 387-1941

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: 7/82 - 3/83

APPROXIMATE COST: $19,000

OBJECTIVES: To prepare a small scale (likely 1:2,000,000) map of B.C. depicting sensitivity of soils and geology to acid precipitation.

METHOD:

a) Sample selected soils in B.C. in conjunction with ongoing inventory projects. These soils will represent a range in geographic locations, classification, and soil properties.
b) In the laboratory using titration curves or other methods, determine buffering capacities of selected soils of B.C. (as noted above).
c) Revise and update criteria for acid sensitivity mapping of B.C. soils/geology consistent with information available and compatible with other mapping in Western Canada.
d) Revise and update small scale map(s) of soils and geology for B.C. to use as a base for sensitivity mapping.
e) Prepare the interpretive sensitivity map.

ANTICIPATED RESULTS:

a) Relationships between soil properties routinely measured/described in conjunction with soil surveys, and measures of soil pH buffering capacities.
b) Criteria for soil and geology sensitivity ratings consistent with available information, level of detail of analysis and scale of mapping being carried out.
c) Revised/refined map of B.C. soils and geology sensitivity to acid precipitation, likely at a scale of 1:2,000,000.

PROJECT NUMBER: 302

SUBJECT CODE: 3.2.2

TITLE: Effects of Acid Precipitation on the Nutrient Cycling Mechanism in a Balsam Fir Stand of the lac Laflamme Catchment: Nutrients in Snow in and Exterior to a Balsam Fir Stand

PRINCIPAL INVESTIGATOR'S NAME: Dr. Gilles Robitaille
DOE, CFS

AGENCY AND DEPARTMENT: Laurentian Forest Research Centre

ADDRESS: P.O. Box 3800
Ste-Foy, Québec
G1V 4C7

PHONE: (418) 658-6945

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: During snow season usually from October to June.
Started January 1980, continues in 1981, 1982, 1983, 1984.

APPROXIMATE COST: $9K from the start of the sampling

OBJECTIVES: To determine the accumulation of nutrients in snow.

To determine the acidity of snow.

METHOD: Snowpack sampled with cylinders or from plastic collectors.

Sampled weekly and analyzed for the major ions.

ANTICIPATED RESULTS:

a) Data on nutrient input and accumulation in the snow,
b) comparison of nutrients in snow between in stand samples and out of stand samples,
c) production of a model to predict snow pH in relation to the major ions (e.g. sulphate, nitrate),
d) production of a model to explain variations in snow pH,
d) data for inputs of ions into the lake ecosystem.

A preliminary report on the modelling should be available by January 1983.

SUBJECT CODE: 3.2.2

PROJECT NUMBER: 303

TITLE: Effects of Acid Precipitation on the Nutrient Cycling Mechanism in Balsam Fir Stands of the lac LaFlamme Catchment: Nutrients in Soil Percolates

PRINCIPAL INVESTIGATOR'S NAME: Dr. G. Robitaille
DOE, CFS

AGENCY AND DEPARTMENT: Laurentian Forest Research Centre

ADDRESS: P.O. Box 3800
Ste-Foy, Québec
G1V 4C7

PHONE: (418) 658-6945

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: Fall 1980 to continuing

APPROXIMATE COST: $8K

OBJECTIVES: To determine the contribution of soil percolates to the nutrient pool of the groundwater and to the aquatic ecosystem.

METHOD: 20 tension lysimeters were set up on the catchment to collect the percolate. 12 were placed in the mineral soil at 1 meter depth and 8 in the organic matter bordering the lake. Samples are analyzed for the major ions by ion chromatography and the pH is measured.

ANTICIPATED RESULTS: Data on the chemistry of percolates as affected by acid throughfall and stemflow.

PROJECT NUMBER: 304

SUBJECT CODE: 3.2.2

TITLE: Effects of Acid Precipitation on the Nutrient Cycling Mechanism Balsam Fir Stands of the lac Laflamme Catchment: Nutrient Distribution in the Throughfall and Stemflow

PRINCIPAL INVESTIGATOR'S NAME: Dr. Gilles Robitaille
DOE, CFS

AGENCY AND DEPARTMENT: Laurentian Forest Research Centre

ADDRESS: P.O. Box 3800
Ste-Foy, Québec
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PHONE: (418) 658-6945

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: September 1980 to end of LRTAP

APPROXIMATE COST: 1980 to 1983: $10K

OBJECTIVES: To determine the nutrient partitioning in a balsam fir stand.

METHOD: 64 balsam fir trees are collared and 65 throughfall receptors were installed to collect the rain water. The water samples were analyzed for the major ions and the pH was measured. Ions were analyzed by ion chromatography and IA.

ANTICIPATED RESULTS:

a) data on nutrient additions to incident precipitation as it passes through the balsam fir canopy,

b) data on ion inputs to the forest floor,

c) data on nutrient cycling.

SUBJECT CODE: 3.2.2

PROJECT NUMBER: 305

TITLE: Effects of Additions of Acid to a Reconstituted Podzol Soil Taken From the lac Laflamme Catchment

PRINCIPAL INVESTIGATOR'S NAME: R. Boutin & G. Robitaille
DOE, CFS

AGENCY AND DEPARTMENT: Laurentian Forest Research Centre

ADDRESS: P.O. Box 3800
Ste-Foy, Québec
G1V 4C7

PHONE: (418) 658-6945

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: September 1980 to approx. end of 1984.

APPROXIMATE COST: To March 1983: $70K

OBJECTIVES: To determine the nutrient release of additions of acid solutions to reconstituted soils profiles of a podzol taken from the lac Laflamme catchment.

METHOD:

a) Soils were divided into horizons and mixed,
b) a filtering system was installed in the plastic columns,
c) known weights of soil were placed into the columns,
d) the soils in the columns were watered with known conc. of acid,
e) leachates were analyzed for pH and major ions including metals.

In phase one acidifying was done with sulphuric acid. These columns have been dismantled and the soils analyzed. In phase two (in progress) columns are being acidified with sulphuric and nitric acid. It is possible that a third phase of acidification with a complete nutrient solution will be performed.

ANTICIPATED RESULTS:

a) data on the rates of nutrient and metal release from a podzol under acid condition,
b) relationships as to rate of podzol degradation,
c) possible data for a nutrient cycling model.

PROJECT NUMBER: 306

SUBJECT CODE: 3.2.2

TITLE: Effects of Acid Precipitation on the Podzolic Soils of the lac Laflamme Catchment: Soil Incubation Studies

PRINCIPAL INVESTIGATOR'S NAME: Dr. Gilles Robitaille
DOE, CFS

AGENCY AND DEPARTMENT: Laurentian Forest Research Centre

ADDRESS: P.O. Box 3800
Ste-Foy, Québec
G1V 4C7

PHONE: (418) 658-6945

COOPERATING AGENCIES AND INVESTIGATORS: Laval University
Dr. C. Camiré

DURATION OF EACH PHASE: September 1980 to March 1982

APPROXIMATE COST: $17K Completed

OBJECTIVES: To determine the effects on nutrient release (short term basis) of adding solutions of differing acidity to given quantities of soil taken from the LF, H, Ae, Bhf_1, Bhf_2, Bf_1, Bf_2, BC and C horizons of a podzolic soil taken from the lac Laflamme catchment.

METHOD:

a) soils were taken from soil pits under balsam fir stands,
b) 5 grams from the organic horizons and 20 grams from the remaining horizons were incubated in 125ml flasks at 5C with 5 and 2ml respectively of solutions containing 2, 10, 20 and 100 meq/100 g of H_2SO_4,
c) two extractions used: deionized water and Morgan's solution. The extraction was done by agitating the incubated soils for one hour in the extracting solution. Solutions were then filtered and analyzed,
d) extractions done to 52 weeks of incubation,
e) major ions analyzed.

ANTICIPATED RESULTS:

a) data on rates and quantities of nutrient release under forced acid conditions,
b) estimates as to rates of podzol degradation,
c) data for possible insertion into a nutrient cycling model for catchment soils under forced acid conditions.

Final report completed on the 30 March 1982.

SUBJECT CODE: 3.2.2

PROJECT NUMBER: 307

TITLE: Chemical Evolution of Acid Precipitation During Infiltration Through Soils

PRINCIPAL INVESTIGATOR'S NAME: J. Lolcama and E.J. Reardon

AGENCY AND DEPARTMENT: Dept. of Earth Sciences, University of Waterloo

ADDRESS: Waterloo, Ontario
N2L 3G1

PHONE: (519) 885-1211
Ext. 3234

COOPERATING AGENCIES AND INVESTIGATORS: Ontario Hydro (H. Johnston)

DURATION OF EACH PHASE: 01/82 - 06/83

APPROXIMATE COST: $10,000

OBJECTIVES: To study the chemical evolution of acid precipitation during infiltration through the unsaturated zone in a podzol soil system.

METHOD:

(a) Soil water samples are collected by centrifuging from soil cores to depths of 5 metres.

(b) Samples are analyzed for major cations and anions, pH, acidity, aluminum, IRON, TOC and deuterium content.

(c) Experimental site is monitored for soil moisture content and gas composition.

ANTICIPATED RESULTS: The determination of the nature, extent and rate of acidity transfer and neutralization reactions during infiltration of acid precipitation through soils in non carbonate terrains.

PROJECT NUMBER: 308

SUBJECT CODE: 3.2.2

TITLE: The Impact of Acidic Precipitation on Subarctic Woodland Soils

PRINCIPAL INVESTIGATOR'S NAME: T. R. Moore

AGENCY AND DEPARTMENT: Geography Department, McGill University

ADDRESS: 805 Sherbrooke Street West
Montreal, Québec
H3A 2K6

PHONE: (514) 392-8245

COOPERATING AGENCIES AND INVESTIGATORS: Atmospheric Environment Service

DURATION OF EACH PHASE: 06/80 - 06/83

APPROXIMATE COST: 06/82 - 06/83: $5,000

OBJECTIVES: To evaluate the impact of different levels of acidic precipitation on the nutrient regime of the soils of the subarctic spruce-lichen woodlands of eastern Canada.

METHOD: (a) Application of twice-weekly doses of simulated rain at pH 3.0, 4.0 and 5.5 to small plots in a woodland, with a control treated with natural rainfall (pH 4.0-5.6). Lysimeters collect leachates, which are analysed for major nutrients (Ca, Mg, K, N and P), pH, Al and SO_4. From these analyses, losses from the soil column can be calculated.

(b) Laboratory experiments being conducted into the leaching of nutrients from post-fire ash, decomposition of soil organic matter and mineralization of N.

ANTICIPATED RESULTS: An evaluation of the potential impact of acidic precipitation on these already nutrient-deficient soils. This evaluation will coordinate with the studies on precipitation by J. E. Lewis, and lichen physiology by M. J. Lechowicz.

SUBJECT CODE: 3.2.2

PROJECT NUMBER: 309

TITLE: Conditions for the Formation of Aluminum Oxide Compounds and Their Identification

PRINCIPAL INVESTIGATOR'S NAME: S. S. Singh, G. J. Ross, H. Kodama

AGENCY AND DEPARTMENT: Chemistry & Biology Research Institute, Agriculture Canada

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Ottawa, Ontario
K1A 0C6

PHONE: (613) 995-3700

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: 04/82

APPROXIMATE COST: $40,000

OBJECTIVES: To understand soil chemical behaviour and soil processes under acidic conditions.

METHOD: Laboratory investigations, chemical and physical examination of the reactants and products.

ANTICIPATED RESULTS:

PROJECT NUMBER: 310

SUBJECT CODE: 3.2.2

TITLE: Chemical Characteristics and Properties of Soils in Sudbury District

PRINCIPAL INVESTIGATOR'S NAME: S. S. Singh

AGENCY AND DEPARTMENT: Chemistry and Biology Research Institute, Agriculture Canada

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Ottawa, Ontario
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PHONE: (613) 995-3700

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: 04/82 - 04/84

APPROXIMATE COST: $30,000

OBJECTIVES: To ascertain the impact of acid forming conditions on soil chemical properties.

METHOD: Collection of soil samples at different depths and in different directions of smoke stack.

Determination of soil properties such as pH, Al, SO_4, base saturation.

ANTICIPATED RESULTS:

SUBJECT CODE: 3.2.2

PROJECT NUMBER: 311

TITLE: Sulfate Anions and the Speciation of Aluminum Ions in Soil Solution

PRINCIPAL INVESTIGATOR'S NAME: S. S. Singh

AGENCY AND DEPARTMENT: Chemistry & Biology Research Institute, Agriculture Canada

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COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: 04/82 - 12/83

APPROXIMATE COST: $30,000

OBJECTIVES: To establish the role of SO_4 ions as they influence the soil solution chemistry of aluminum.

METHOD: By subjecting soil samples to different concentrations of SO_4 ions and then evaluating the soil solution composition.

ANTICIPATED RESULTS:

PROJECT NUMBER: 312

SUBJECT CODE: 3.2.2

TITLE: Baseline Physico-Chemistry of the Soils of the lac Laflamme Catchment

PRINCIPAL INVESTIGATOR'S NAME: Dr. G. Robitaille and R. Boutin
DOE, CFS

AGENCY AND DEPARTMENT: Laurentian Forest Research Centre

ADDRESS: P.O. Box 3800
Ste-Foy, Québec
G1V 4C7

PHONE: (418) 658-6945

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: Soils sampled in September 1980 and 1981. Terminated.
Soils to be resampled in 1983.

APPROXIMATE COST: $5K

OBJECTIVES: To obtain data on the physico-chemical characteristics of the podzol under balsam fir.

METHOD: a) soils taken at 17 permanent plots on the catchment,

b) soils analyzed using standard techniques.

ANTICIPATED RESULTS: a) date for comparisons to samples to be collected in 1983,

b) possible data for a nutrient cycling model,

c) baseline data for laboratory leachate experiments.

SUBJECT CODE: 3.2.2

PROJECT NUMBER: 313

TITLE: Effect of Simulated Acid Precipitation on Composition of Percolate from Reconstructed Profiles of two Northern Ontario Forest Soils

PRINCIPAL INVESTIGATOR'S NAME: Dr. Ian K. Morrison

AGENCY AND DEPARTMENT: Department of the Environment, Canadian Forestry Service

ADDRESS: Great Lakes Forest Research Centre
P.O. Box 490
Sault Ste. Marie, Ontario
P6A 5M7

PHONE: (705) 949-9461

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: Setup: 1977
Operation: 1977 to at least 1987

APPROXIMATE COST: $5,000 per annum, including salaries

OBJECTIVES:

a) To compare products of leaching, chiefly bases, H^+-ion and SO_4^{--}-ion from reconstructed profiles of two northern Ontario forest soils under different regimes of dilute H_2SO_4 addition.

b) To compare effects of different dilute H_2SO_4 addition on soil chemical properties.

METHOD:

a) Two soils (a podzol and a brunisol, both from beneath mid-age jack pine forest) were reconstructed into 100 cm high column lysimeters.

b) Dilute H_2SO_4 ranging in pH from 5.6 to 2.0, but at environmentally realistic rate, i.e., 1000 mm/annum has been dripfed to each of the 24 columns weekly since mid-1977.

c) Volumes are measured weekly; monthly the following are determined on the percolates: pH, specific conductance, K^+, Ca^{++}, Mg^{++}, Na^+, several trace metals, SO_4^{--}.

d) At the culmination of the experiment the soil will be analyzed by horizons.

ANTICIPATED RESULTS: Time course of SO_4^{--} retention, then movement is followed in relation to loading together with time-course of cation transport.

PROJECT NUMBER: 314

SUBJECT CODE: 3.2.2

TITLE: Effects of Acid Precipitation on Two Soils Near Kingston Ontario

PRINCIPAL INVESTIGATOR'S NAME: G. K. Rutherford

AGENCY AND DEPARTMENT: Department of Geography

ADDRESS: Queen's University
Kingston, Ontario
K7L 3N6

PHONE:

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: Concludes March 31, 1983

APPROXIMATE COST: Approximately $17K over 3 years

OBJECTIVES: To determine the effects of natural and acidified precipitation on a Gray-Brown Luvisolic soil under grass and on a Brunisolic soil under deciduous forest.

This project has been funded for several summers. In past summers the field equipment which consisted of lysimeters sunken into the soil were established, fenced off and initial leaching attempted. By the summer of 1981 the experiment appeared to be operating satisfactorily and a summer of results were obtained. In 1982, the lysimeters were sunken to three different depths in the loam Brunisol and two in the clay Luvisol.

The leachates were analysed on a weekly basis - the lysimeters were leached on Friday and the leachates collected on Monday and analysed for common cations and anions during the week. For each depth one lysimeter was leached with natural rainfall whilst the other was leached by simulated rainfall of pH 4.0 - as well as the natural rainfall which had a pH of 4.3 - 4.0.

METHOD: The soil samples in the columns which were analysed using common pedological methods are compared with soil samples of the same materials which were set aside when the experiment started.

Unedited results of the analyses of 1981 and 1982 have been submitted to the Atmospheric Environment Service but a formal report will be completed during 1983.

SUBJECT CODE: 3.2.2

PROJECT NUMBER: 315

TITLE: Soil Geochemistry Surveys in Ontario (Project C2)

PRINCIPAL INVESTIGATOR'S NAME: D. W. Cowell

AGENCY AND DEPARTMENT: Lands Directorate

ADDRESS: P.O. Box 5050
Burlington, Ontario
L7R 4A6

PHONE: (416) 637-4552

COOPERATING AGENCIES AND INVESTIGATORS: OMWR Ontario
MOE Ontario

DURATION OF EACH PHASE:

APPROXIMATE COST: $30K proposed for contractor salary (1983-84)

OBJECTIVES:

- To provide quantitative laboratory investigations of geochemistry soil survey samples collected in selected areas of Ontario in 1982-83.
- To develop an effective evaluation and model of geochemical interactions of H_2SO_4 on Canadian rural and forest soil systems.
- To complement proposed terrestrial ecosystem studies by Lands Quebec and Atlantic staff.

METHOD:

ANTICIPATED RESULTS: Laboratory analysis and reports on sensitivity of Canadian Soils to H_2SO_4 including SO_4^{2-} absorption capacity and aluminum interactions.

RELEVANCE: Project follows on from survey and sampling of Canadian soil system initiated in 1982-83. Due to failure of LRTAP Cabinet Submission data was archived for remainder of 1982-83. Project research and data to be produced have been consistently identified in MOI reports, work group meetings and elsewhere as an urgent and critical component in understanding of LRTAP ecosystem interactions and impacts. Project thus responds directly to MOI needs and should provide timely results to ongoing DOE research program in 1983-84.

PROJECT NUMBER: 316

SUBJECT CODE: 3.2.2

TITLE: Ecosystem Sensitivity Analysis (Project C1)

PRINCIPAL INVESTIGATOR'S NAME: D. W. Cowell, Lands Ontario (project leader),
A. E. Lucas, Lands Ontario
G. Gilbert, Lands Quebec
H. Hirvonen, Lands Halifax

AGENCY AND DEPARTMENT: Lands Directorate

ADDRESS: P.O. Box 5050
Burlington, Ontario
L7R 4A6

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COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE:

APPROXIMATE COST: Proposed $27K (O&M) and $1.8K P/Y (1983-84)

OBJECTIVES:

- To finalize an effective ecological data base for LRTAP terrestrial sensitivity assessment.
- To complete sensitivity map and report, of eastern Canada in response to MOI reporting requirements.
- To develop improved ecosystem sensitivity assessment methodologies and modelling through computer based and manual techniques.

METHOD:

ANTICIPATED RESULTS: Detailed report on methodology for LRTAP Sensitivity Assessment
- At least one conference paper on terrestrial Sensitivity modelling
- Improved and more detailed sensitivity maps and initial quantitative data evaluations.

RELEVANCE: MOI Reporting requirements for Phase III and beyond have identified critical needs for improved sensitivity map and quantitative sensitivity assessment. Hence project is designed to respond directly to program MOI needs and to be refined as MOI evaluation information evolves.

SUBJECT CODE: 3.2.2

PROJECT NUMBER: 317

TITLE: The Degenerative Effects of Acid Precipitation on Two Common Forest Soil Types in Eastern Canada

PRINCIPAL INVESTIGATOR'S NAME: Professor G. K. Rutherford

AGENCY AND DEPARTMENT: Department of Geography, Queen's University

ADDRESS: Kingston, Ontario
K7L 3N6

PHONE:

COOPERATING AGENCIES AND INVESTIGATORS: Professor G. Van Loon - Dept. of Chemistry
Queen's University

Professor R. B. Stewart - Dept. of Microbiology
Queen's University

DURATION OF EACH PHASE: The project is scheduled to conclude May 31, 1983 but owing to the heavy capital investment in plexiglass columns it is hoped that certain aspects of the project may be refunded on a more modest scale.

APPROXIMATE COST: $212K

OBJECTIVES:

METHOD:

(1) The effects of acid precipitation on a Podzolic soil supporting boreal forest at Montmorency, Quebec and mixed deciduous/boreal forest on a Brunisolic soil near Sault Sainte Marie is being investigated in laboratory columns. The columns are being leached with simulated precipitation solutions at pH 5.6, 3.5 and 2.0. The leachates are constantly monitored by chemical and microbiological analyses. After certain periods of time certain of the columns will be broken down and the pedological, chemical and microbiological properties of these will be examined and compared with the original soils. These columns are approximately 60 cm in depth.

(2) Short undisturbed 25 cm columns of the L, H, Ae and Bfl horizons of the above soils are being leached at a considerably greater rate with similar solutions. After approximately the equivalent of 10 years leaching, these columns will also be broken down and examined in the same way as the long columns.

(3) Selected samples from #2 above are subjected to a Soxhlet extraction process using extractants of similar pH as #1 and #2 above but of slightly different composition. (The high BP of H_2SO_4 rendered this total analogy impossible.) After considerable leaching the samples will be dried and removed and examined in the same way as #1 and #2 above. In this instance microscopic analyses will be performed on the samples to estimate for example, the fate of iron oxide cutans etc.

The associated researchers are Professors G. Van Loon and R. B. Stewart of the Department of Chemistry and Microbiology respectively at Queen's University.

PROJECT NUMBER: 318

SUBJECT CODE: 3.2.2

TITLE: Interactions of Acid Rain and Nitrogen Transformation Processes

PRINCIPAL INVESTIGATOR'S NAME: M. K. Mahendrappa

AGENCY AND DEPARTMENT: Environment Canada, Canadian Forestry Service

ADDRESS: Maritimes Forest Research Centre
P.O. Box 4000
Fredericton, N.B.
E3B 5P7

PHONE: (506) 452-3549

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: 1981-86

APPROXIMATE COST: $20K (82-83)

OBJECTIVES: To characterize nitrogen transformation processes in the forest ecosystems of the Maritimes region, and to determine their interactions with acid rain and other air pollutants.

METHOD:

a) An incubation experiment will be conducted to study N mineralization in organic materials affected, to different degrees, by SO_2 pollution.

b) Collect and evaluate data on nutrient cycling in eight forest stands at Acadia Forest Experiment Station (AFES), New Brunswick.

c) Monitor quality and quantity of open-rain, event samples collected at AFES.

ANTICIPATED RESULTS: Work done to date to characterize nutrient cycling processes constitutes one of the most extensive sets of data on baseline characteristics of different forest ecosystems in eastern Canada. An identification of sensitive bio-monitors of acid rain effects and a measure of these effects will follow.

SUBJECT CODE: 3.2.2

PROJECT NUMBER: 319

TITLE: Interaction Between Acid Rain and Forest Soil Organic Transformations

PRINCIPAL INVESTIGATOR'S NAME: P. O. Salonius

AGENCY AND DEPARTMENT: Environment Canada, Canadian Forestry Service

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E3B 5P7

PHONE: (506) 452-3548

COOPERATING AGENCIES AND INVESTIGATORS: K. E. Percy
Maritimes Forest Research Centre

DURATION OF EACH PHASE: Part-time 1/81 - 12/83

APPROXIMATE COST: $500/year

OBJECTIVES: Investigate the effect of simulated acid rain on forest soil microbial activity.

METHOD:

a) Forest soils will be treated with varying pH's of acid rain in laboratory simulated rainfall chambers.

b) Oxygen uptake patterns of the treated soils will be studied.

c) Ammonium and nitrate production will be investigated in modified soils after prolonged incubation.

ANTICIPATED RESULTS: Data will be published.

PROJECT NUMBER: 320

SUBJECT CODE: 3.2.2

TITLE: Effects of Acid Rain on Vegetation and Soils in Newfoundland

PRINCIPAL INVESTIGATOR'S NAME: Dr. S. S. Sidhu

AGENCY AND DEPARTMENT: Canadian Forestry Service, Newfoundland Forest Research Centre

ADDRESS: P.O. Box 6028
St. John's, Newfoundland
A1C 5X8

PHONE: (709) 772-4829

COOPERATING AGENCIES AND INVESTIGATORS:

a) Department of Environment
Government of Newfoundland and Labrador
Dr. Les Hulett and Mr. B. Power

b) J. G. Zakrevsky
Canadian Forestry Service, Newfoundland

DURATION OF EACH PHASE:

a)	Field sampling & analysis of plants	7/80 - 6/81
b)	Setup greenhouse facilities	3/81 - 5/83
c)	Setup simulated experiments	6/83 - 11/83
d)	Collect soil samples	6/82 - 9/82
e)	Laboratory analysis	8/83 -

APPROXIMATE COST: 5/80 - 4/83 - $200,000

OBJECTIVES:

a) To determine the potential use of foliar buffering capacity for indexing the relative sensitivity of forest species to acid precipitation.

b) To determine the effects of acid rain on pollen and seed germination and seedling growth in tree species dominant in Newfoundland forests.

c) To determine the long-term effects of simulated acid rain on selected forest soils including nutrient depletion and degree of irreversibility of effects and their subsequent effect on plant growth.

d) To evaluate, develop and adopt method for S-analysis in plants and soils.

METHOD:

a) Standard methods of soil and plant analysis will be followed. Methods may be modified if difficulties encountered during the study.

b) Soil leachates will be collected from soils for chemical analysis for cations and anions including sulphates, aluminum and trace metals.

SUBJECT CODE: 3.2.2

PROJECT NUMBER: 320 (cont'd)

ANTICIPATED RESULTS:

a) Buffering Capacity for Foliage: A new approach of using B.C. as a measure of species sensitivity to acidic pollutants has been developed and is under evaluation. A standardized method for determining B.C. has been published (Plant & Soil), Vol. 66: 173-179). Based on the seasonal and annual variations in B.C. of selected individuals of several species studied for two consecutive years, it is concluded that difference in B.C. among individuals and species are consistent and genetically controlled. This fact now established provides a basis for further testing of species sensitivity to acid rain and the relationship of species sensitivity to the foliar B.C. In addition to the variations in B.C., changes in nutrient status of foliage including sulphur were also studied. The data are being analysed at present.

b) Effects of Acid Rain on Pollen and Seed Germination: The experiments to study the effect of simulated acid rain on pollen of balsam fir, black spruce and white spruce have already been completed.

The results indicate that pollen germination and pollen tube growth in balsam fir, black spruce and white spruce are probably not effected at acidity levels of rain occurring in Newfoundland at this time. Only rain with acidities lower than 3.6 inhibited pollen germination and pollen tube in the three tree species.

c) Long-Term Effects of Acid Rain on Soils and Plant Growth: A 200 m^2 greenhouse facility fitted with the acid rain dispersing mechanisms is under construction and is expected to be completed by February 1983. In anticipation of its completion, 150 soil intact soil profiles (25 cm diam., 60 cm depth) have been collected from a balsam fir-white birch site from western Newfoundland. The soil profiles will be sprayed with rain of five acidities at the average monthly rates of rainfall recorded for St. John's. The input and output of ions will be studied for a long term. The effect of change in nutrient status of soils on growth of selected forest species will be studied for 1, 2, 5 and 10 years.

d) An ion-chromatography method for sulphur analysis in plant materials was developed. The results were presented at the "24th Rocky Mountain Conference, Denver, Colorado", August 1982 by J.G. Zakrevsky.

PROJECT NUMBER: 321

SUBJECT CODE: 3.2.2

TITLE: The Effect of Acid Precipitation on Southern Ontario Soils

PRINCIPAL INVESTIGATOR'S NAME: M.A. Griffith and D. E. Simma
(Supervisor: Dr. S. N. Linzon)

AGENCY AND DEPARTMENT: Ontario Ministry of the Environment, Air Resources Branch
Phytotoxicology Section

ADDRESS: 880 Bay Street, Suite 347
Toronto, Ontario
M5S 1Z8

PHONE: (416) 965-4516

COOPERATING AGENCIES AND INVESTIGATORS: Ontario Ministry of Natural Resources
Ontario Ministry of Agriculture and Food

DURATION OF EACH PHASE: Program commenced 1982 and scheduled to continue until 1987.

APPROXIMATE COST: $380K (1982-83)

OBJECTIVES:

1. To establish the baseline status for chemical and physical constituents in undisturbed soils.
2. To develop criteria for soil sensitivity to acidic deposition and to map soils with respect to (a) forest productivity, (b) water quality, (c) soil changes.
3. To determine the natural spatial and seasonal variation in soil parameters within a small area at a sampling site.
4. To document micromorphological changes in soil induced by acid precipitation.

METHOD:

1. Sample soil to parent material near precipitation collectors; analyze soil for various chemical and physical properties; re-examine soil sites periodically.
2. Re-sample old soil surveys; leach various horizons of major soil orders with simulated acid rain at different pH levels and monitor soil leachate chemistry, produce buffering curves for S. Ontario soil.
3. Systematically re-sample soil sites on a 10 m grid seasonally and analyse for various chemical and physical properties.
4. Microscopically examine acid treated soil and soil thin sections under polarized light; perform energy dispersive analyses on soil thin sections.

ANTICIPATED RESULTS:

1. Produce substantial and reliable data base of soil chemistry on which future changes caused by acidic deposition may be compared; to provide soil data for mapping purposes.
2. Establish trends in soil chemistry related to acidic deposition input.
3. Expect some natural seasonal and spatial variation in soil chemistry over a small site, useful in separating natural variations in soil from those induced by acid precipitation.
4. Document physical and chemical soil weathering induced by acid, extrapolate accelerated weathering processes to those occurring in nature.

CODE DU SUJET: 3.2.2

NUMÉRO DE PROJET: 322

TITRE: Effet des dépots acides sur la disponibilité des bio-éléments de la matière organique en milieu forestier

NOM DU CHERCHEUR RESPONSABLE: Dr. T. D. Phu et Dr. G. Robitaille
DOE, CFS

MINISTÈRE, ORGANISME OU ORGANISME PRIVÉ, SERVICE: Laurentian Forest Research Centre

ADRESSE: P.O. Box 3800
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TÉLÉPHONE: (418) 658-6945

COLLABORATEUR(S), ORGANISME(S) ET CHERCHEUR(S):

DURÉE DE CHAQUE PHASE: Fall 1981 to Fall 1984

COÛT APPROXIMATIF: $10K

OBJECTIFS DE TRAVAIL:

1. Etablir d'ici 1985 les effets des dépôts acides accélérés, in situ, sur les propriétés physico-chimiques de la matière organique d'une sapinière, et

2. déterminer la disponibilité et la teneur des bio-éléments de la végétation au sol, en caractérisant la physico-chimie de la matière organique et de la végétation, en acidifiant, in situ, la matière organique à des pH de 3, 4 et 5.6; en déterminant l'accumulation des bio-éléments par la végétation au sol suite à l'application d'acide.

MÉTHODE DE TRAVAIL:

1. Les 40 placettes échantillons déjà sélectionnées sur le bassin hydrologique du lac Laflamme, seront arrosées avec de l'eau acidifiée provenant du lac Laflamme, à pH 3, 4 et 5. Un quatrième et cinquième traitement seront faits avec l'eau du lac et la précipitation normale. Les arrosages se feront en 4 répétitions avec 10 litres d'eau répandus sur les parcelles de 75 cm x 75 cm, avec une fréquence de 2 semaines;

2. douze échantillons de sol répartis au hasard dans chaque parcelle seront récoltés pour en faire un échantillon composé. Les échantillons (total 2160) seront récoltés en mai 82, juillet 82 et octobre 82. Ils seront analysés par couches (L, F et H) pour les ions majeurs incluant Fe et Al échangeables, le $SO_4^=$, $NO_3^=$;

3. une partie de la végétation au sol sera relevée dans chaque parcelle au début et à la fin de l'expérience et sera analysée pour les bio-éléments.

RÉSULTATS PRÉVUS:

NUMÉRO DE PROJET: 323

CODE DU SUJET: 3.2.3

TITRE: Utilisation de la dendrochronologie comme indice de pollution de fluorures atmosphériques originant des alumineries québécoises

NOM DU CHERCHEUR RESPONSABLE: Marcel Ouellet

MINISTÈRE, ORGANISME OU ORGANISME PRIVÉ, SERVICE: INRS-Eau, Université du Québec

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TÉLÉPHONE: (418) 657-2555

COLLABORATEUR(S), ORGANISME(S) ET CHERCHEUR(S): Dr. Gilles Robitaille
Environnement Canada

DURÉE DE CHAQUE PHASE:

a) échantillonnage: automne 1982
b) analyse: hiver 1982-83
c) rédaction: printemps 1983

COÛT APPROXIMATIF:

OBJECTIFS DE TRAVAIL: Reconstituer et estimer au moyen des cernes annuels des arbres localisés dans la région de plusieurs alumineries du Québec la réduction de la croissance attribuable au fluorures atmosphériques.

MÉTHODE DE TRAVAIL: Echantillonnage des arbres et reconstituer le taux de croissance en fonction du temps. Correller l'épaisseur des anneaux annuels en fonction des émissions de fluorures estimées par le tonnage d'aluminium produit annuellement depuis le début des opérations de chaque usine.

RÉSULTATS PRÉVUS: Une réduction d'environ 50% de la croissance du pin gris provoquée par les émissions de fluorures des usines.

SUBJECT CODE: 3.2.3

PROJECT NUMBER: 324

TITLE: Determination of the Toxicity of Aluminum to the Root Systems of Boreal Forest Tree Species Under Controlled Conditions

PRINCIPAL INVESTIGATOR'S NAME: Dr. Thomas C. Hutchinson

AGENCY AND DEPARTMENT: University of Toronto, Department of Botany

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Toronto, Ontario
M5S 1A1

PHONE: (416) 978-3532

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: Autumn 1982 to Autumn 1984

APPROXIMATE COST: ca. $35,000 per year

OBJECTIVES: To determine the effect of aluminum and of manganese in the rooting medium, as influenced by calcium and magnesium, on the health, growth and mineral composition of seedlings of ten important Canadian tree species.

METHOD: Seedlings of white pine, red pine, jack pine, white spruce, red spruce, black spruce, white birch, red oak, sugar maple and red maple will be grown in sand-filled pots. One series will be supplied with nutrient solutions varying in aluminum concentration, a second series will be supplied with solutions varying in manganese concentration. In both series calcium and magnesium will be supplied at two levels. Seedlings will be grown under treatment for 60 days then harvested. At harvest, root condition will be examined and various growth parameters determined. Concentrations of various elements will be determined.

ANTICIPATED RESULTS: In a second experiment, effects of aluminum and manganese concentrations on radicle elongation will be determined.

PROJECT NUMBER: 325

SUBJECT CODE: 3.2.3

TITLE: Potential Effects of Acid Precipitation on the Germination, Growth and Mycorhysation of Balsam Fir Seedlings and on the Decomposition of Organic Matter

PRINCIPAL INVESTIGATOR'S NAME: C. Camiré, Laval University
G. Robitaille (Scientific Authority)
DOE, CFS

AGENCY AND DEPARTMENT: Laurentian Forest Research Centre

ADDRESS: P.O. Box 3800
Ste-Foy, Québec
G1V 4C7

PHONE: (418) 658-6945

COOPERATING AGENCIES AND INVESTIGATORS: Laval University

DURATION OF EACH PHASE: 1981-1982: Terminated

APPROXIMATE COST: $11K

OBJECTIVES: To detect possible effects of acidity on balsam fir seedlings and on organic matter decomposition.

METHOD: For germination: sterilized balsam fir seeds were germinated aseptically on acidified sand.

For growth: seeds were germinated on organic matter taken from a balsam fir stand and then acidified.

For mycorhysation: one meter square plots were acidified in the field and effects noted after six weeks of watering.

For decomposition: organic matter was incubated in acid solutions and decomposition was measured by CO_2 method.

ANTICIPATED RESULTS: Data on the effects of acidification.

SUBJECT CODE: 3.2.3

PROJECT NUMBER: 326

TITLE: Physiological Effect of Low Concentrations of NO_X on Alberta Plant Species

PRINCIPAL INVESTIGATOR'S NAME: Dr. S. Krupa

AGENCY AND DEPARTMENT: Research Management Division, Alberta Environment

ADDRESS: 14th Floor, Standard Life Centre
10405 Jasper Avenue
Edmonton, Alberta
T5J 3N4

PHONE: (403) 427-3943

COOPERATING AGENCIES AND INVESTIGATORS: Dr. A. H. Legge
Kananaskis Centre for Environmental Research
University of Calgary
Calgary, Alberta

DURATION OF EACH PHASE: Commenced 1980

APPROXIMATE COST: $111,180 (82-83)

OBJECTIVES: The project will determine the sensitivity of selected plant species to injury by low concentrations of NO and/or NO_2. In addition, the ability of certain plant species to acclimate to low concentrations of nitrogen oxides will be investigated. The effects of NO_X/SO_2 and NO_X/H_2S mixtures on plant species will be considered.

METHOD: Develop and test microfumigation chambers for use with oxides of nitrogen. Monitor emissions and visually assess symptoms of vegetation damage near selected compressor stations. Relate visual symptoms to fumigation studies. Characterize whole plant responses, in lab, of pine and aspen to normal environmental stresses. Evaluate, in lab, symptom development in pine and aspen to NO_X fumigation. Investigate new methods and approaches for assessment of the effects of acid gases on vegetation.

ANTICIPATED RESULTS: A report will be available by the end of 1982 from the Research Management Division, Alberta Environment.

PROJECT NUMBER: 327

SUBJECT CODE: 3.2.3

TITLE: Protection of the Biotic Environment

PRINCIPAL INVESTIGATOR'S NAME: Mr. B. Munson

AGENCY AND DEPARTMENT: Research Management Division, Alberta Environment

ADDRESS: 14th Floor, Standard Life Centre
10405 Jasper Avenue
Edmonton, Alberta
T5J 3N4

PHONE: (403) 427-3943

COOPERATING AGENCIES AND INVESTIGATORS: Work contracted out to Dr. E. C. Pielou
University of Lethbridge
Department of Botany
Lethbridge, Alberta
(403) 329-2245

Alberta Oil Sands Technology and Research Authority

DURATION OF EACH PHASE:

APPROXIMATE COST: $35,000 (82-83)

OBJECTIVES: The primary objective of this project is to attempt to isolate the effects of aerial emissions on the forest ecosystem from natural environmental effects.

METHOD: Estimate total bio-mass of aspen within an area 70km x 35km centred on the Suncor plant, with a North-South orientation. Within this region, past growth rates, present health of trees and present state of ground vegetation will be estimated so as to judge the relative importance of productivity of the three chief temporally fluctuating conditions (tent caterpillar, fire and air pollution), and the constant environmental conditions, such as soil type, slope and aspect.

ANTICIPATED RESULTS: Completion of project is expected in 1984 and the results will be available from the Research Management Division, Alberta Environment.

SUBJECT CODE: 3.2.3

PROJECT NUMBER: 328

TITLE: Research in Support of Biomonitoring: The Response of Vegetation to Aerial Emissions

PRINCIPAL INVESTIGATOR'S NAME: Mr. B. Munson

AGENCY AND DEPARTMENT: Research Management Division, Alberta Environment

ADDRESS: 14th Floor, Standard Life Centre
10405 Jasper Avenue
Edmonton, Alberta
T5J 3N4

PHONE: (403) 427-3943

COOPERATING AGENCIES AND INVESTIGATORS: Work contracted out to Dr. George La Roi
Department of Botany
University of Alberta
Edmonton, Alberta
T6G 2E9

DURATION OF EACH PHASE: Commenced in 1980

APPROXIMATE COST: $48,425 (82-83)

OBJECTIVES: The project investigates the short and long term response of vegetational communities to aerial emissions. It compares the structural dynamics in non-contaminated boreal forest ecosystems to those induced in boreal forests exposed to aerial emissions.

METHOD: Contact principal investigator for methodologies.

ANTICIPATED RESULTS: Two reports on baseline states are available from the Research Management Division, Alberta Environment.

PROJECT NUMBER: 329

SUBJECT CODE: 3.2.3

TITLE: Effects of Acidic Precipitation Simulants on Vegetation under Greenhouse and Field Conditions

PRINCIPAL INVESTIGATOR'S NAME: A. L. Kuja & M. Lichtenberg
(Supervisor: Dr. S. N. Linzon)

AGENCY AND DEPARTMENT: Ontario Ministry of the Environment, Air Resources Branch
Phytotoxicology Section

ADDRESS: Brampton, Ontario

PHONE: (416) 456-2504

COOPERATING AGENCIES AND INVESTIGATORS: Ontario Ministry of Natural Resources
Ontario Ministry of Agriculture and Food

DURATION OF EACH PHASE: Program commenced 1982 and scheduled to continue until 1987

APPROXIMATE COST: $300,000 (1982-83)

OBJECTIVES: To determine possible detrimental effects of simulated acidic precipitation on yield of agricultural crops and productivity of commercially valuable forest species.

To document foliar injury etc., and relate these to symptoms observed in the field.

To determine possible interactions between acid rain and O_3 and SO_2.

METHOD: Greenhouse-rain simulation chambers - potted agricultural plants and forest seedlings are subjected to acid rain simulants in controlled environment experiments.

Automated field systems consisting of mobile exclusion canopies for excluding ambient rain and applying rain stimulants to determine effects on crops established in the field.

ANTICIPATED RESULTS: Dose-Response functions for yield and foliar injury of various crops and forest species.

SUBJECT CODE: 3.2.3

PROJECT NUMBER: 330

TITLE: Physiological and Biochemical Effects of Simulated Acid Rain on Native Boreal Species

PRINCIPAL INVESTIGATOR'S NAME: Dr. G. D. Hogan

AGENCY AND DEPARTMENT: Environment Canada, Canadian Forestry Service

ADDRESS: 5320 - 122 Street
Edmonton, Alberta
T6H 3S5

PHONE: (403) 435-7307

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: 1983-88

APPROXIMATE COST: $12K/year

OBJECTIVES:

1) To determine the dose-response relationships of native species to simulated acid rain.

2) To determine the physiological changes that are symptomatic of acid rain induced injury.

METHOD:

1. Seedlings and older plants of native species will be exposed to simulated acid rain under controlled conditions.

2. Investigations of physiological response to these conditions will be carried out.

ANTICIPATED RESULTS:

1) A sensitivity listing of regional tree species to simulated acid rain.

2) Publication of results in the scientific literature.

PROJECT NUMBER: 331

SUBJECT CODE: 3.2.3

TITLE: Impact of Acid Deposition on Forest Hydrologic Processes

PRINCIPAL INVESTIGATOR'S NAME: Dr. J. A. Nicolson

AGENCY AND DEPARTMENT: Department of the Environment, Canadian Forestry Service

ADDRESS: Great Lakes Forest Research Centre
P.O. Box 490
Sault Ste. Marie, Ontario
P6A 5M7

PHONE: (705) 949-9461

COOPERATING AGENCIES AND INVESTIGATORS:

a) DOE, Inland Waters Directorate
b) DFO, Great Lakes Biolimnology Laboratory
c) OMNR, Sault Ste. Marie District

DURATION OF EACH PHASE: Operation: 7/80 to at least 12/85

APPROXIMATE COST: 4/83 to 3/84 - $75K

OBJECTIVES: Over a five-year period to elucidate the influence of atmospheric deposition of acidifying substances upon the hydrochemical cycle and the export of elements from forested catchments through the collection of water samples and the measurement of runoff volumes.

METHOD: In an old-growth hard maple-yellow birch watershed on shallow till soils (Turkey Lake Forest Watershed).

a) Fourteen small gauged watersheds have been established and are sampled weekly.
b) Six additional watersheds are also sampled and flow measured weekly.
c) Twelve plots have been established in one basin and three in each of two other basins, where event sampling is done to study the partitioning of both the volume and chemistry of gross precipitation before it reaches the forest floor.
d) Chemical analysis of samples is carried out in the Great Lakes Forest Research Centre laboratory.

ANTICIPATED RESULTS:

a) Reports outlining acid rain effects on the terrestrial ecosystem study and the effects of the system on the acid rain before it enters the lakes and major streams.

b) Eventual development of process models involving hydrologic processes.

SUBJECT CODE: 3.2.3

PROJECT NUMBER: 332

TITLE: Impact of Acid Deposition on Forest Productivity

PRINCIPAL INVESTIGATOR'S NAME: Dr. Ian K. Morrison

AGENCY AND DEPARTMENT: Department of the Environment, Canadian Forestry Service

ADDRESS: Great Lakes Forest Research Centre
P.O. Box 490
Sault Ste. Marie, Ontario
P6A 5M7

PHONE: (705) 949-9461

COOPERATING AGENCIES AND INVESTIGATORS:
DOE, Inland Waters Directorate
DFO, Great Lakes Biolimnology Laboratory (Dr. J.R.M. Kelso)
OMNR, Sault Ste. Marie District

DURATION OF EACH PHASE:
Setup: 1980
Operation: 1980 to at least 1985

APPROXIMATE COST: $70,000 per annum, including salaries

OBJECTIVES:
a) To elucidate the influence of atmospheric deposition of acidifying substances upon production and turnover processes within the vegetation of forest ecosystems.
b) To elucidate the modifying influence of the vegetation of forest ecosystems on precipitation properties.
c) To participate in the development of process models involving forest growth and biogeochemical processes.

METHOD:
a) Study is being carried out on 3 main study sites in old-growth hard maple-yellow birch woods, Algoma District, Ontario, and is closely coordinated with those of Drs. N. Foster and J. Nicolson.
b) Growth is being measured on large numbers of PSPs, correlations with soil chemical factors will be attempted.
c) Standing crop biomass and bioelement reserves have been estimated.
d) Transfer in litter is being ascertained by studies of litter-fall and litter chemistry (transfer in by throughfall, stemflow being studied by colleagues).
e) Studies of litter decomposition rate in relation to acid treatment is being undertaken.

ANTICIPATED RESULTS: Data, together with those of colleagues, will be used to calibrate a process model relating acid decomposition and productivity of northern Ontario old-grown hardwood forest.

PROJECT NUMBER: 333

SUBJECT CODE: 3.2.3

TITLE: Effects of Acidic Deposition on Forest Vegetation in Northwestern Ontario

PRINCIPAL INVESTIGATOR'S NAME: Dr. H. Dennis Griffin

AGENCY AND DEPARTMENT: Ontario Ministry of the Environment

ADDRESS: P.O. Box 5000
Thunder Bay, Ontario
P7C 5G6

PHONE: (807) 475-1215

COOPERATING AGENCIES AND INVESTIGATORS:

Contractor:
Dr. Paul Barclay
Biology Department
Lakehead University
Thunder Bay, Ontario
P7B 5E1

Cooperating Agency:
Phytotoxicology Section
Air Resources Branch
Ontario Ministry of the Environment

(Dr. S. N. Linzon)

DURATION OF EACH PHASE: Program commenced May, 1980 and is scheduled to continue until 1987.

APPROXIMATE COST: $240K (1/4/82-31/3/83)

OBJECTIVES:

1. Establish baseline status for chemical constituents of vegetation in northwestern Ontario.
2. Document changes in elemental distribution and nutrient cycling within a boreal forest ecosystem.

METHOD:

1. Approximately 55 sites sampled in 1981 and 1982, with an additional 10 sites to be sampled in 1983.
2. A watershed study area of approximately 80 hectares has been selected at a location about 40 kilometers northwest of Thunder Bay. Intensive monitoring is scheduled to commence at this site in 1983, including measurements of SO_2, O_3, NO_X and meteorological data, incident precipitation, precipitation throughfall and stemflow, litterfall, soil leachate, groundwater and surface water outflow.

ANTICIPATED RESULTS:

1. Baseline sampling should enable future changes caused by long-range atmospheric deposition to be detected.
2. Biogeochemical studies at the watershed will assist in understanding the effects of acidification on a mixed-forest ecosystem in northwestern Ontario.

SUBJECT CODE: 3.2.3

PROJECT NUMBER: 334

TITLE: Effects of Acidic Deposition on Forest Soils in Northwestern Ontario

PRINCIPAL INVESTIGATOR'S NAME: Dr. H. Dennis Griffin

AGENCY AND DEPARTMENT: Ontario Ministry of the Environment

ADDRESS: P.O. Box 5000
Thunder Bay, Ontario
P7C 5G6

PHONE: (807) 475-1215

COOPERATING AGENCIES AND INVESTIGATORS:

Contract:	Cooperating agency:
Dr. Paul Barclay	Phytotoxicology Section
Biology Department	Air Resources Branch
Lakehead University	Ontario Ministry of the Environment
Thunder Bay, Ontario	
P7B 5E1	(Dr. S. N. Linzon)

DURATION OF EACH PHASE: Program commenced May, 1982, and is scheduled to continue until 1987.

APPROXIMATE COST: $50K (1/4/82-31/3/83)

OBJECTIVES:

1. Establish baseline status for chemical constituents and physical properties in forest soils in northwestern Ontario.
2. Conduct accelerated leaching experiments on selected forest soils.
3. Determine long-term changes in open-top soil columns.
4. Map soils with respect to sensitivity to acidification.

METHOD:

1. Approximately 65 sites sampled in 1981 and 1982. Ten additional sites to be sampled in 1983.
2. Preliminary laboratory soil leaching experiments completed in 1981. Further experiments scheduled for 1983.
3. Install open-top soil columns containing different soil types at four Ontario sites.
4. Determine soil sensitivity criteria, based on leaching experiments and other studies.

ANTICIPATED RESULTS:

1. Baseline sampling will enable future changes caused by long-range atmospheric deposition to be detected.
2. Leaching experiments may provide an estimate of the number of years for precipitation currently deposited on northwestern Ontario to affect soils and vegetation.
3. Open-top soil columns will provide an indication of long-term changes in soils exposed to natural precipitation/deposition in Ontario.
4. Soil sensitivity map should be useful in indicating potential impact of acidic deposition on forest productivity and aquatic environment.

PROJECT NUMBER: 335

SUBJECT CODE: 3.2.3

TITLE: The Effects of Atmospheric Effluents from Mining and Smelting Industries on Forest Vegetation and Soils in Northern Manitoba

PRINCIPAL INVESTIGATOR'S NAME: D. L. Wotton/G. D. Hogan

AGENCY AND DEPARTMENT: Environmental Management Division
Department of Consumer and Corporate Affairs and Environment

ADDRESS: P.O. Box 7, Building 2
139 Tuxedo Avenue
Winnipeg, Manitoba
R3N 0H6

PHONE: (204) 895-5311

COOPERATING AGENCIES AND INVESTIGATORS: Canadian Forestry Service
Northern Forest Research Centre
Environment Canada

DURATION OF EACH PHASE:
a) Setup: 5/82 - 10/82
b) Operation: 5/79 - 10/82

APPROXIMATE COST: For 5/82 - 10/82: $32,300

OBJECTIVES:
a) The objective of this network is to sample bulk deposition of metals within a 40 km radius of northern mining smelters in rainfall and moss traps.

b) The results will be used to determine deposition rates and to support the interpretation of vegetation and soil sampling.

METHOD:
a) At an established network of eight sites located in the primary areas of dispersion from smelters at Thompson and Flin Flon, a closed precipitation collector is established to collect above the forest canopy. In addition, moss traps are placed in replicates of 5 per site.

b) At four week intervals, samples are collected and analyzed for pH, Zn, Cu, Pb, Fe, Ni and Cd.

ANTICIPATED RESULTS:
a) Identification, quantification and extent of particulate contaminants present.

b) Background dispersion and accumulation data for determination of air pollutant impingement.

SUBJECT CODE: 3.2.3

PROJECT NUMBER: 336

TITLE: Determination of the Sensitivity of the Pollination Processes of Different Forest Flora Species to Simulated Acid Rain

PRINCIPAL INVESTIGATOR'S NAME: Dr. R. M. Cox

AGENCY AND DEPARTMENT: Department of Botany and Institute for Environmental Studies

ADDRESS: University of Toronto
Toronto, Ontario
M5S 1A1

PHONE: (416) 978-7339

COOPERATING AGENCIES AND INVESTIGATORS: CFS
Maritimes Forest Research Centre
P.O. Box 4000
Fredericton, New Brunswick
E3B 5P7

DURATION OF EACH PHASE: June 1981 - June 1982

APPROXIMATE COST: June 1981 - June 1982 $56,810

OBJECTIVES: To study the effects of acidity and simulated acid rain on the reproductive processes in higher plants.

METHOD:

1) *In vitro* pH susceptibility screening of pollens in liquid culture.
2) Spray chamber acid precipitation simulation effect on stigma receptivity.
3) Field simulation effects on stigma receptivity and seed set.

ANTICIPATED RESULTS:

1) Relative sensitivity rank of forest flora pollens.
2) Identification of sensitive species and dose response thresholds for pH effects on reproductive processes.

PROJECT NUMBER: 337

SUBJECT CODE: 3.2.3

TITLE: To Determine the Sensitivity of Wet Deposited Trace Elements and Acid Due to Long Range Transported Air Pollutants on Reproductive Processes of Forest Flora Species

PRINCIPAL INVESTIGATOR'S NAME: Dr. R. M. Cox

AGENCY AND DEPARTMENT: Department of Botany and Institute for Environmental Studies

ADDRESS: University of Toronto
Toronto, Ontario
M5S 1A1

PHONE: (416) 978-7339

COOPERATING AGENCIES AND INVESTIGATORS:
CFS
Maritimes Forest Research Centre
P.O. Box 4000
Fredericton, New Brunswick
E3B 5P7

DURATION OF EACH PHASE: October 1982 - October 1984

APPROXIMATE COST: October 1982 - October 1984 $120,000

OBJECTIVES: To study the response of acidity and trace elements on reproductive processes in some forest flora species.

METHOD:

1) In vitro assay of pollens to combination of acidity and various trace elements in liquid culture.

2) Spray chamber simulations of acid precipitation containing various concentrations of trace elements and acidity and their effects on stigma receptivity.

3) Field simulation of acid precipitation on stigma receptivity and seed set.

ANTICIPATED RESULTS:

1) Relative sensitivity ranking of pollen from key economic species to pH and trace elements found in acidic precipitation.

2) Dose response thresholds for various trace elements effects on reproductive processes.

SUBJECT CODE: 3.2.3

PROJECT NUMBER: 338

TITLE: Environmental Impacts of Forest Productivity

PRINCIPAL INVESTIGATOR'S NAME: Stan R. Megraw

AGENCY AND DEPARTMENT: Domtar Inc., Centre de Recherches

ADDRESS: C.P. 300
Senneville, Québec
H9X 3L7

PHONE: (514) 457-6810

COOPERATING AGENCIES AND INVESTIGATORS: G. H. Tomlinson II, Domtar Inc.
Domtar Inc., Forest Products Division

DURATION OF EACH PHASE: 05/83 - 12/84

APPROXIMATE COST: 05/83 - 12/84 $240K

OBJECTIVES: Conduct field studies to evaluate whether or not Domtar Inc.'s freehold or licenced forests which are susceptible to acid deposition and which demonstrate poor yield and/or regeneration characteristics exhibit signs of acid-related stress or damage.

METHOD:

a) Evaluation of tree condition and determination of nutrient requirements.

b) Inventory of litter and soil quality with emphasis on measurements of exchangeable cations and evaluation of nutrient status.

c) Location measurements of dry and wet deposition in open areas adjacent to forest stands and throughfall beneath the forest canopies.

ANTICIPATED RESULTS: Definition of casual factor(s) responsible for poor yield and/or regeneration of Domtar Inc.'s forests, either associated with acid deposition or some other environmental stress.

PROJECT NUMBER: 339

SUBJECT CODE: 3.2.3

TITLE: Environmental Impacts on Forest Productivity

PRINCIPAL INVESTIGATOR'S NAME: Stan R. Megraw

AGENCY AND DEPARTMENT: Domtar Inc. - Centre de Recherches

ADDRESS: C.P. 300
Senneville, Québec
H9X 3L7

PHONE: (514) 457-6810

COOPERATING AGENCIES AND INVESTIGATORS: G. H. Tomlinson II, Domtar Inc.
Domtar Inc., Forest Products Division

DURATION OF EACH PHASE: 09/82 - 05/83

APPROXIMATE COST: 09/82 - 05/83 $50K

OBJECTIVES: Review all available documentation to establish which of Domtar Inc.'s major freehold and licenced forests are in areas most sensitive to acid deposition and which demonstrate poor yield and/or regeneration characteristics.

METHOD:

a) Characterize Domtar Inc.'s freehold and licenced forests in terms of their soil types and nutrient status, bedrock geology, species distribution; general health, growth and regeneration characteristics; and forest management practices.

b) Review deposition data from the national precipitation monitoring networks CANSAP and NADP relative to Domtar Inc.'s forests.

c) Review the literature dealing with terrestrial ecosystem perturbations resulting from acid deposition.

ANTICIPATED RESULTS: Demonstration that certain of Domtar Inc.'s forested areas are impinged by and sensitive to acid deposition and show signs of poor yield and/or regeneration.

SUBJECT CODE: 3.2.3

PROJECT NUMBER: 340

TITLE: Effects of Metal Particulate and Sulphur Deposition on Soil Biological Processes

PRINCIPAL INVESTIGATOR'S NAME: Dr. G. D. Hogan

AGENCY AND DEPARTMENT: Environment Canada, Canadian Forestry Service

ADDRESS: 5320 - 122 Street
Edmonton, Alberta
T6H 3S5

PHONE: (403) 535-7307

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: 1983 - 1988

APPROXIMATE COST: $5K/year

OBJECTIVES: To investigate the effects of metal particulate and sulphur (SO_2, SO_4) deposition on soil biological processes.

METHOD: Soil samples taken from around point sources will be used to determine the effects of metal particulate and sulphur deposition on selected soil enzymatic and other biologically mediated processes.

ANTICIPATED RESULTS: Publication of results in the scientific literature.

PROJECT NUMBER: 341

SUBJECT CODE: 3.2.3

TITLE: Direct Effects of Simulated Acid Rain on Forest Trees

PRINCIPAL INVESTIGATOR'S NAME: K. E. Percy

AGENCY AND DEPARTMENT: Environment Canada, Canadian Forestry Service

ADDRESS: Maritimes Forest Research Centre
P.O. Box 4000
Fredericton, N.B.
E3B 5P7

PHONE: (506) 452-3532

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: 5/80 - 12/83

APPROXIMATE COST: $45K (5/80 - 12/83)

OBJECTIVES:

a) To determine the interspecific sensitivity of at least fourteen eastern Canadian forest tree species to simulated acid rain.

b) To initiate work on the morphology of individual species response, and to document alterations in plant form and development induced by acid rain.

METHOD: Various pH's (2.6, 3.6, 4.6, 5.6) of rain will be applied to tree seedlings at a rainfall intensity, volume, and droplet diameter modelled on those measured at a forest site in central New Brunswick. Rain chemistry will be derived from 1980 growing season rain data collected at the same site.

ANTICIPATED RESULTS: Data on the sensitivity of Acadian forest tree species to simulated acid rain in terms of germination, establishment and subsequent growth parameters will be published.

SUBJECT CODE: 3.2.3

PROJECT NUMBER: 342

TITLE: Kejimkujik Catchments Study

PRINCIPAL INVESTIGATOR'S NAME: K. E. Percy

AGENCY AND DEPARTMENT: Environment Canada, Canadian Forestry Service

ADDRESS: Maritimes Forest Research Centre
P.O. Box 4000
Fredericton, N.B.
E3B 5P7

PHONE: (506) 452-3532

COOPERATING AGENCIES AND INVESTIGATORS: Dr. J. J. Kerekes, CWS

DURATION OF EACH PHASE AND APPROXIMATE COST:

a) Field Collection of inventory data, vegetation and soil samples: 8/79 - 10/80 - $12,500
b) Chemical Analysis of samples. 10/80 - 12/81 for baseline characterization - $200,000
c) Precipitation Collection: 5/81 - 10/83 (5 - 10 of each year) - $10,000/year
d) Resurvey of baseline conditions on site monitoring 7/82 onwards - $7,000
e) Sample soil water chemistry in precipitation collection plots 5/83 - 10/83 - $10,000

OBJECTIVES:

a/b) To characterize the baseline condition of the forest vegetation and soils within the Beaverskin and Pebbleloggitch catchments in Kejimkujik National Park, N.S.
c) To determine LRTAP and nutrient input into the catchments through the monitoring of non-intercepted and intercepted precipitation (stemflow and throughfall).
d) To elucidate trends in the forest ecology of the catchments and identify any LRTAP effects through long-term continuous monitoring.
e) To study the influence of the forest soils in the catchments on the quality of intercepted rainfall.

METHOD:

a/b) An intensive forest inventory will be completed. Forest soils in the catchments will be sampled and a chemical and physical analysis performed. Species composition, density, primary productivity and nutrient data will be generated for the tree, shrub, herb and moss-lichen vegetation layers.
c) Precipitation samples will be collected at least weekly with an event sampling period during the summer.
d) Periodic resurvey of the plant-soil systems will be used to monitor long-term trends.
e) Soil water will be periodically sampled from selected horizons underneath the precipitation chemistry study plots.

ANTICIPATED RESULTS: A report detailing the baseline characteristics of the catchments will be prepared.

PROJECT NUMBER: 343

SUBJECT CODE: 3.2.4

TITLE: Effects of Environmental Sulphur on Farm Animals

PRINCIPAL INVESTIGATOR'S NAME: Dr. M. G. Prior

AGENCY AND DEPARTMENT: Toxicology Group, Animal Sciences Wing

ADDRESS: Alberta Environmental Centre
Vegreville, Alberta

PHONE: (403) 632-6767

COOPERATING AGENCIES AND INVESTIGATORS: Alberta Agriculture
Alberta Environment

DURATION OF EACH PHASE: Commenced April 1981

APPROXIMATE COST: $246,633 (82-83)

OBJECTIVES: This study will define the role of indirect exposure to sulphur-containing emissions on Alberta cattle specifically; the incidence of certain reproductive and infectious diseases, reduced productivity and trace element nutritional deficiencies. The role of direct exposure to sulphur-containing emissions on the health and productivity of cattle will be determined.

METHOD: Contact principal investigator for project methodology.

ANTICIPATED RESULTS: The results of a pilot project are available from the Toxicology Group, Animal Sciences Wing, Alberta Environmental Centre.

SUBJECT CODE: 3.2.4

PROJECT NUMBER: 344

TITLE: Ozone Damage Assessment

PRINCIPAL INVESTIGATOR'S NAME: Dr. K. Puckett, Dr. K. Anlauf

AGENCY AND DEPARTMENT: Atmospheric Environment Service, Environment Canada

ADDRESS: 4905 Dufferin Street
Downsview, Ontario
M3H 5T4

PHONE: (416) 667-4885

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: To March 1983

APPROXIMATE COST: $5.0K

OBJECTIVES: To assess ozone damage to vegetation.

METHOD: Oxidant damage to crops, orchards and vegetation in general in regions of eastern Canada influenced by the long range transport of air pollutants are to be examined and related to ambient levels of ozone.

ANTICIPATED RESULTS: A report on oxidant injury to vegetation in eastern Canada.

PROJECT NUMBER: 345

SUBJECT CODE: 3.2.4

TITLE: Acidic Rain/Ozone Interaction on White Bean

PRINCIPAL INVESTIGATOR'S NAME: G. Hofstra

AGENCY AND DEPARTMENT: Department of Environmental Biology, University of Guelph

ADDRESS: Guelph, Ontario
N1G 2W1

PHONE: (519) 824-4120
Ext. 2737

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: 09/81 - 12/83

APPROXIMATE COST:

OBJECTIVES:

1. Determine the effects of simulated acidic rain on white bean leaves.
2. Determine the effect of simulated acidic rain on white bean sensitivity to ozone.

METHOD:

1. Greenhouse grown plants are treated with acidic rain and exposed to O_3 in fumigation chambers.
2. White bean plots in the field are treated with acidic rain of differing pH and ozone injury from natural episodes assessed.

ANTICIPATED RESULTS: An indication of whether acidic rain increases the sensitivity of the already highly sensitive white bean crop to ozone injury and premature defoliation.

SUBJECT CODE: 3.2.4

PROJECT NUMBER: 346

TITLE: Influence of Ozone on White Bean in Southern Ontario

PRINCIPAL INVESTIGATOR'S NAME: T. J. Gillespie

AGENCY AND DEPARTMENT: Land Resource Science

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COOPERATING AGENCIES AND INVESTIGATORS: Atmospheric Environment Service
(Dr. H. H. Neumann)

DURATION OF EACH PHASE: Completed during Summer 1982.

APPROXIMATE COST: $6,300

OBJECTIVES: To investigate the effect of stomatal closure, and planting date (plant age), on ozone injury to white beans in the field.

METHOD: Beans were planted at several successive dates and stomatal manipulation was attempted by controlled irrigation. Phenological observations (plant size, flowers, pods) and stomatal measurements were made at regular intervals, along with monitoring of ambient ozone and plant damage. Some plants were prevented from fruiting by the removal of flowers.

ANTICIPATED RESULTS: Stomatal closure is effective in reducing ozone flux to leaves, and plant age (onset of fruiting) is the most important factor governing visible damage. Plants not allowed to fruit showed substantially less damage than fruiting plants of similar age.

PROJECT NUMBER: 347

SUBJECT CODE: 3.2.4

TITLE: Effects of Ozone and SO_2 on Vegetation: Field Investigations

PRINCIPAL INVESTIGATOR'S NAME: Jane Spavold

AGENCY AND DEPARTMENT: Environmental Services Branch, Environment New Brunswick

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COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: 05/10/82

APPROXIMATE COST: 1982 $2,000

OBJECTIVES:
- to assess the extent of ozone and SO_2 injury to vegetation in Saint John and other major industrial centres in New Brunswick;
- to respond to complaints of suspected air pollution damage to vegetation.

METHOD:
- regular assessment of selected vegetation plots throughout the growing season;
- response to complaints of vegetation damage.

ANTICIPATED RESULTS:
- regular reports to complainants;
- interim report available, 1982.

SUBJECT CODE: 3.2.5

PROJECT NUMBER 348

TITLE: Effects of Methylmercury, Lead and Cadmium Contamination on the Reproduction Rate and Demography of Wildlife Populations in Ontario

PRINCIPAL INVESTIGATOR'S NAME: K. L. Fischer

AGENCY AND DEPARTMENT: Environment Canada, Canadian Wildlife Service

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COOPERATING AGENCIES AND INVESTIGATORS: Ontario Ministry of Natural Resources
University of Guelph

DURATION OF EACH PHASE:

APPROXIMATE COST: 1983-1984: $25K 1984-1985: $25K 1985-1986: $25K

OBJECTIVES: To determine the above contaminant burdens in wildlife (mink, otter, moose) within areas impinged by acid rain. To correlate observed levels of contamination with age, sex, reproductive rate and demographic characteristics of the local population. To evaluate the impact of acid precipitation in terms of contaminant burdens and productivity of these species.

METHOD: Central Ontario is in an area of acid deposition and is considered susceptible to acidification (Shilts et al. 1980, Geol. Surv. Can. paper 81-14). Recent data shows that the pH of many lakes in this area is dropping (M. Thompson, unpubl. data). Ontario MNR personnel are collecting tissues of hunter killed moose in the Dorset area. The livers and kidneys provided to CWS will be analyzed for cadmium and lead concentrations in 1983 and a further study will be planned for 1984 - 1985 following the next hunting season in central Ontario. Carcasses of mink and/or otter will be collected from trappers in 1984 and 1985 and tissues will be analyzed for Hg, Cd and Pb. Reproductive data will be recorded for females and ages determined.

ANTICIPATED RESULTS:

1) Individual contaminant levels will be correlated with the relative acidification of relevant ecosystems.
2) Reproductive output should be impaired with increased contaminant burdens.

PROJECT NUMBER: 349

SUBJECT CODE: 3.2.5

TITLE: The Effects of Aluminum Toxicity and Calcium Deficiency on the Reproductive Success of a Captive Population of Ring Doves

PRINCIPAL INVESTIGATOR'S NAME: K. L. Fischer

AGENCY AND DEPARTMENT: Environment Canada, Canadian Wildlife Service

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PHONE: (819) 997-1410

COOPERATING AGENCIES AND INVESTIGATORS:
D. B. Peakall, Canadian Wildlife Service
P. A. Angehrn, Canadian Wildlife Service

DURATION OF EACH PHASE: Three feeding trials will be run three months each-followed by a period to establish new pairs. Starting January, 1983 and ending in September, 1984.

APPROXIMATE COST: 1983-1984: $20K 1984-1985: $20K 1985-1986: $10K

OBJECTIVES: To examine the effects of aluminum intoxication and calcium deficiency on the reproductive output and growth of captive ring-necked doves (Streptopelia risoria) and to determine the conditions under which these effects would occur in acid-stressed areas.

METHOD: Purified diets with three levels of calcium, phosphorus and aluminum will be fed to breeding adult doves over three series of feeding experiments. The birds will be maintained on the diets for the period surrounding breeding up until the eggs are laid and chicks are hatched and weaned. This procedure will be followed for two groups of birds; one set to be used for egg analysis and the other for assessment of reproductive success. Shells will be saved for Scanning Electron Microscopy and tissues analyzed for aluminum content.

ANTICIPATED RESULTS: Feeding experiments will be carried out in 1983 and 1984. Interim reports will be prepared following data collection on each feeding trial. Final report to be prepared by December, 1985.

SUBJECT CODE: 3.2.5

PROJECT NUMBER: 350

TITLE: Effects of Acid Precipitation on the Productivity of the Caribou Lichens

PRINCIPAL INVESTIGATOR'S NAME: Martin J. Lechowicz

AGENCY AND DEPARTMENT: McGill University, Department of Biology

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PHONE: (514) 392-4683

Sabbatic Address (08/82-08/83):
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COOPERATING AGENCIES AND INVESTIGATORS: CWS: K. Fischer, Ottawa
G. Shaw, Edmonton

DURATION OF EACH PHASE: 04/82 to 04/83

APPROXIMATE COST: $25K

OBJECTIVES:

a) to assess the effects of simulated acid rain on the photosynthetic and respiratory metabolism of 5 subarctic lichens used as forage by caribou,

b) to integrate these results in a simulation model of the climatic control of lichen productivity including the effects of acidification of summer precipitation.

METHOD:

a) laboratory studies of Cladina stellaris, C. mitis, C. rangiferina, Alectoria ochrolevca and Cetraria cocullata responses to wetting by simulated acid rain, pH 2.5 to 5.6.

b) field acidification trials of C. stellaris mats in subarctic Quebec with pH 2.5 to 5.6 and sulfate:nitrate ratios of 2:1 and 6:1 in a 5 replicate, randomized complete block design.

c) comparison of simulated production under the diverse acidification regimes with that observed in the field trials.

ANTICIPATED RESULTS: Improved, quantitative model predicting annual production of the principal caribou forage lichens under a range of acidification regimes.

PROJECT NUMBER: 351

SUBJECT CODE: 3.2.5

TITLE: Assessment of the Impact of Acid Precipitation on Aquatic Wildlife in the Atlantic Provinces

PRINCIPAL INVESTIGATOR'S NAME: J. J. Kerekes

AGENCY AND DEPARTMENT: Environment Canada, Canadian Wildlife Service, Atlantic Reg.

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COOPERATING AGENCIES AND INVESTIGATORS: Inland Water Directorate
Water Quality Branch
Moncton, New Brunswick

DURATION OF EACH PHASE: 1982 and 1983, work in Nova Scotia
1984 and 1985, work in New Brunswick
1986, work in Newfoundland
1987, final report

APPROXIMATE COST: 1983-1984: $20K

OBJECTIVES: Assess the long-term effects of habitat damage on the populations of wildfowl and quantify the habitat and food losses in the Atlantic Region wetlands.

METHOD: Approximately 20-30 wetlands are selected from the Wetlands Inventory each year for a few years, including regions known to be heavily impacted by atmospheric deposition. Each wetland will be sampled for major ions, gran alkalinity, metals, nutrients, and organic carbon. Biological sampling will include vegetation transects and invertebrate abundance. Wildlife distribution and abundance will be studied in the wetlands selected. Emphasis will be placed to determine the acidity tolerance levels of several key species of aquatic vegetation and aquatic invertebrates. In addition to pH, calcium and organic carbon levels will be considered to determine acidity tolerance. Distribution and abundance of aquatic wildlife will be related to key plant and invertebrate species at various pH, calcium and organic carbon levels. The observed pH levels will be related to known atmospheric loadings using the Henriksen model and the sensitivity and response of the wetlands to acid loading will be determined. An attempt will be made to select suitable wetlands to determine what roles wetlands have in buffering waters.

ANTICIPATED RESULTS: Identification and quantification of wetlands sensitive to acid precipitation.
Assessment of wildlife habitat loss due to acid precipitation in the Atlantic Region.
Determination of the impact of acid precipitation on naturally acidic wetlands, and the distinction between edaphic (natural) acidification and atmospheric acidification.

SUBJECT CODE: 3.2.5

PROJECT NUMBER: 352

TITLE: Availability of Prey for Selected Species of Waterbirds in Southern Quebec in Areas Susceptible to Acidification

PRINCIPAL INVESTIGATOR'S NAME: Mr. Jean-Luc DesGranges

AGENCY AND DEPARTMENT: Environment Canada, Canadian Wildlife Service

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Ste-Foy, Quebec
G1V 4H5

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COOPERATING AGENCIES AND INVESTIGATORS:
- Environment Québec
- contractor to be determined

DURATION OF EACH PHASE:

APPROXIMATE COST: 1983-1984: $50K 1984-1985: $20K

OBJECTIVES: To determine the availability of food organisms for selected species of waterbirds in the Laurentide and Outaouais areas of Québec.

METHOD: Determine species diversity and abundance of minnows and macroinvertebrates in lakes of southern Quebec already studied as part of the CWS-LRTAP research. Relate presence or absence of major groups of prey organisms to the pattern of waterbird distribution and water chemistry characteristics. Examine the influence of biogeographical features vs. acidification on the presence of waterbirds and their prey.

ANTICIPATED RESULTS: Report on the distribution of waterbirds in lakes of varying acidity in southern Québec and the importance of key prey organisms in the patterns observed. Report on the role of acidification in the distribution of waterbirds and their prey.

PROJECT NUMBER: 353

SUBJECT CODE: 3.2.5

TITLE: Selenium Deficiency Disease in Native Wild Herbivores

PRINCIPAL INVESTIGATOR'S NAME: George G. Shaw

AGENCY AND DEPARTMENT: Canadian Wildlife Service, DOE

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Edmonton, Alberta
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PHONE: (403) 435-7355

COOPERATING AGENCIES AND INVESTIGATORS: None

DURATION OF EACH PHASE:

APPROXIMATE COST: 1983-84: $5K A Base, $10K base
1984-85: $15K
1985-86: $15K

OBJECTIVES:

1. Livetrap Microtus pennsylvanicus in known large areas of high or low selenium concentration in pasture grasses within Alberta.
2. Measure selenium concentration of gut contents and identify food plant species from gut contents.
3. If selenium concentration of gut contents are correlated with average vegetative selenium concentrations of selected areas, establish laboratory populations of Microtus from these high and low selenium areas of Alberta.
4. Rear Microtus from high and low selenium areas on laboratory diets of high and low selenium concentration. Several response parameters, i.e. weight gain, incidence of sperm abnormalities, GSH-Px enzyme activity, etc. will be measured to determine if voles from different areas are differentially adapted to dietary selenium deficiency.

METHODS: Objective 1. Alberta Agriculture has done approximately 15,000 selenium determinations on fields in Alberta. These data can be readily used to identify areas of high (200 ppb) and low (25 ppb) selenium for pasture vegetation. Live trapping of small mammals has been carried on extensively for severals years by CWS in our region for other projects.

METHODS: Objective 2. Similarly, the collection and identification of gut contents from Microtus is a routine activity. Se analysis would be done by hydride generation or automated fluorometry as in previous research.

Objective 3. Laboratory populations of Microtus and other microtines have been maintained by us using contracted University of Alberta facilities at Ellerslie, Alberta. Microtus populations would be maintained initially on several different prepared diets for several generations to determine optimum nutrition.

Objective 4. The selected diet would be manipulated to provide high (200 ppb) and low (5 ppb) concentrations of selenium without changing its other chemical constituents. Equal numbers of Microtus from high and low selenium areas (outbred laboratory populations) would be reared on these two selenium diets for several generations. The methodology for measuring each response parameter would be based on known literature descriptions. Preliminary trials would allow us to gain the necessary proficiency with the methods.

ANTICIPATED RESULTS: Objective 1: Animals will be live trapped in both high and low selenium areas.

Objective 2-3: a) Selenium concentration in gut contents and in average available foods consumed by Microtus will be correlated. These concentrations will be low in expected low selenium areas and high in expected high selenium areas.

b) Selenium concentration in gut contents will be high in areas of expected low selenium areas suggesting Microtus selects for high selenium food items. Such behaviour would constitute the basis for a new research direction not considered here.

Objective 4: This objective would probably be dropped if b) outcome above were achieved. Otherwise, Microtus from high selenium areas should suffer some degree of selenium deficiency as measured by the several response parameters. Microtus from low selenium areas should be affected less severely or not at all by the selenium deficient diet.

RELEVANCE: Even if the SO_2 and SO_4 sub projects demonstrate that future expected exposures of vegetation to these S forms will results in a lowering of selenium concentration in wild herbivore foods it will be necessary to show that native wild herbivores can suffer from selenium deficiencies. The rational for this can be found below.

PROJECT NUMBER: 354

SUBJECT CODE: 3.2.5

TITLE: Effects of SO_2 and Acid Rain SO_4 on the elemental composition of plants consumed by wild herbivores.

PRINCIPAL INVESTIGATOR'S NAME: George G. Shaw

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PHONE: (403) 435-7355

COOPERATING AGENCIES AND INVESTIGATORS: None

DURATION OF EACH PHASE: SO_2 subproject: 1983-84 is terminal year of 3
SO_4 subproject: 1983-84 is terminal year of 3

APPROXIMATE COST: 1983-84 - $10K to cover both subprojects

OBJECTIVES:

a) To determine if the element concentration, particularly that of selenium, changes in leaves and twigs of 3 plant species exposed to different concentrations of SO_2 and acid rain SO_4 during a 3 year period.

b) To assess the *in vitro* dry matter digestibility (IVDMD) of the above materials using rumen fluids.

c) To determine Se concentrations and IVDMD in lichen samples provided by M. Lechowicz (McGill University). Lichens have been differentially treated with acid rain SO_4 for 2 years.

METHOD: SO_2 subproject. Several plants of western serviceberry, 2 willow species and red fescue grass growing in 22 litre pots of 1:1:1 peat moss, vermiculite and silica sand (PVS) were placed in the maximum impact zone downwind of several SO_2 sources in Alberta and at control sites (no SO_2) in 1980 and 1981. Exposure to SO_2 at each site is monitored monthly with standard lead oxide sulphation plates. Inductively coupled argon plasma emission spectrometry (about 25 elements) and hydride generation (selenium) are used to determine element concentrations in foliage collected from plants at each site at the end of the growing season annually. In 1983-84 terminal twigs in additional to leaves will be sampled because they too are consumed by ungulates such as moose.

SUBJECT CODE: 3.2.5

PROJECT NUMBER: 354 (cont'd)

METHOD: SO_4 subproject. Several plants of serviceberry and fescue grass in 22 litre pots of PVS soil have been exposed (2 years now) to twice weekly waterings with 500 mls of zero, 7.5 or 15 ppm SO_4 solutions of distilled water. This quantity and water quality approximates current rainfalls of eastern N.A. The experiemental design at NFRC also includes PVS soils without Se (.003 ppm) vs. with Se (0.1 ppm) and whole plant applications vs. soil surface applications. Pots are otherwise fertilized once in the spring each year. Elemental concentrations of plant materials according to treatment combination are assessed annually as in the SO_2 subproject.

The IVDMD method has been used successfully with livestock for several years and more recently by Thomas and Kroeger (Arctic 33(4) 1980, 34(4) 1981) to assess food quality differences between plant species or plants differentially treated in some way.

ANTICIPATED RESULTS: Concentrations of foliar and/or twig selenium may be lower in plants exposed to higher field concentrations of SO_2 or higher acid rain SO_4 concentrations. This would be consistent with laboratory results reported earlier (Shaw 1981 - Proc. 38th NE Fish and Wildlife Conf. (for SO_2) 1981 - CWS man. rept. (for SO_4)).

The IVDMD method may show that higher SO_2 or SO_4 treated plants produce less digestible food for wild ruminants.

RELEVANCE: If negative effects of excessive S on the availability of the essential element selenium (for warm blooded vertebrates) is shown in these field experiments then, a new terrestrial dimension will be added to the potentially harmful effects of acid rain. Large herbivores such as caribou, moose, elk and deer are ecologically and economically important in Canada. Plausible demonstration that these wildlife resources will be affected by the expected S emissions during the next two decades will provide new justification for preventing such emission levels in both Canada and United States.

The IVDMD method largely measures available energy in food for a herbivore. Available energy is affected by fiber content, element content, lipid carbohydrate, protein content and other chemical constituents of the plant. Accordingly the IVDMD method permits direct assessment of excessive SO_2 and SO_4 effects on available energy for the wild herbivore, thus avoiding expensive plant chemistry analysis and interpretation.

PROJECT NUMBER: 355

SUBJECT CODE: 3.2.5

TITLE: Effect of Acidic Precipitation on Waterfowl Populations in Northern Ontario

PRINCIPAL INVESTIGATOR'S NAME: D. K. McNicol
R. K. Ross

AGENCY AND DEPARTMENT: Department of the Environment, Canadian Wildlife Service

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COOPERATING AGENCIES AND INVESTIGATORS:
Great Lakes Forestry Research Centre (GLFRC - Neil Foster - Ray Semkin)
Fisheries and Oceans Canada (J. Kelso)
Ontario Ministry of Natural Resources
Ontario Ministry of Environment

DURATION OF EACH PHASE:

APPROXIMATE COST:

1983-84		1984-85
A Base	B Base	
$28.1K	$30K	$25K

OBJECTIVES: 1) To determine if correlations exist between acid rain levels and the status of waterfowl populations as defined by breeding distribution density and overall productivity measurements.

2) To examine the mechanisms by which waterfowl respond to changes in the chemical status and trophic structure of their habitat arising from acidification
3) To develop and test a means of predicting how certain waterfowl species are likely to respond in the future to continuing acidification.

METHOD: CWS field activities for the 1983-84 fiscal year will be conducted in two regions of the province subjected to different degrees of LRTAP-related stress. To date, CWS (ONT) LRTAP studies have been confined to the Algoma District and in particular Ranger Lake which experiences moderate levels of SO_2 deposition (long range transport) with mean annual pH of precipitation less than 4.4. Wetlands in this area are currently undergoing acidification with low or exhausted buffering capacities common in headwater ponds and lakes. Yet truly acidic lakes are rare. From historical data, we know that many lakes in the Killarney-Sudbury-Wanapitei area have become acidified over the past few decades as a result of point source deposition which has substantially altered and reduced aquatic biota supported by these wetlands. The acidic lakes common in the Sudbury Region would be ideal for comparisons with lakes currently studied in the Ranger Lake area where variability in buffering capacity is useful in understanding the response by waterfowl to biological changes occurring in a system undergoing acidification.

METHOD: The 1983-1984 field activities will be conducted in both the Ranger Lake and Sudbury areas and will include the following components:

1) Broadening the existing data base in Ranger Lake:
   a) continued monitoring of the breeding distribution and density of waterfowl in Algoma as ascertained from aerial surveys during nest initiation. Such

monitoring will provide data on yearly variability in breeding habitat preferences required to evaluate the potential long-term consequences of continued acidification to waterfowl populations in northern Ontario.

b) continued investigation of waterfowl productivity on a small set of lakes in the Ranger Lake area. Based on aquatic invertebrate and minnow data collected in 1981 on 36 lakes ranging in degree of sensitivity to acidification, a continued program of brood surveillance on selected waterbodies is important to the completion of the work.

2) Testing hypotheses in an acidified area:

Given the knowledge of general habitat selection patterns generated in the Ranger Lake area since 1980, testing hypotheses in an acidified area (Killarney-Sudbury-Wanapitei) will require the collection of very specific information using procedures developed at Ranger Lake. The following components will be included:

a) Aerial surveys of acidic wetlands to assess breeding densities and distributional patterns of common waterfowl species will be conducted to compare general patterns of habitat selection in an acidic environment with patterns observed in Algoma using air photo interpretation of major wetland habitat characteristics.

b) Ground studies conducted in the Killarney-Sudbury-Wanapitei area will provide information on the potential mechanisms by which acidification has influenced waterfowl productivity under acidic condition and will include:
- waterfowl productivity studies (monitoring brood behaviour and movements to assess utilization and reproductive success),
- collection of relevant habitat information including vegetation, lake morphometry and water chemistry;
- food chain studies designed to determine the impact of acidification on aquatic invertebrates and minnows which ultimately influence habitat selection and reproductive success of waterfowl.

3) Completion of data analyses and write-up:
Continued analyses of data collected up to and including the 1983 field season will be required prior to the production of further reports on the work.

ANTICIPATED RESULTS

1) Document the extent to which distributions and densities of waterfowl breeding in sensitive areas of northern Ontario have been affected by acidic precipitation. Comparisons between patterns habitat selection patterns observed in an area presently undergoing acidification (Ranger Lake) and an area containing many acidic lakes (Killarney-Sudbury-Wanapitei) will determine the degree to which acidification and other relevant chemical factors have led to changes in waterfowl nesting patterns.

2) Evaluate food-chain relationships under acidic conditions. In the Ranger Lake area, benthic and in particular pelagic macroinvertebrate populations were found to vary dramatically between lakes containing viable minnow populations and lakes where minnows were not detected, analagous to changes in trophic structure observed following acidification in Sweden (Eriksson et al. 1980, Ambio 9: 248-249). By testing to see whether comparable trophic relationships are present in acidic lakes in the Sudbury area, while simultaneously assessing waterfowl utilization, an understanding of waterfowl response to a changing resource state as a direct result of acidification can be obtained.

PROJECT NUMBER: 356

SUBJECT CODE: 3.2.5

TITLE: Reproduction of Passerine Birds in Areas of pH Stress - Killarney Provincial Park, Ontario

PRINCIPAL INVESTIGATOR'S NAME: Mr. P. Blancher
114 William Street
Kingston, Ontario
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Funded by: V. Glooschenko

AGENCY AND DEPARTMENT: Ontario Ministry of Natural Resources, Wildlife Branch

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COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: Field work: May-Aug '82
Data analyses and summary report: Sept. '82 - Feb. '83

APPROXIMATE COST: $25K

OBJECTIVES: To assess whether pH stress affects the reproduction of passerine birds which, when nesting near aquatic environments, utilize emerging aquatic insects as a major food source.

METHOD: Species observed were: Eastern Kingbird, Tree Swallow, Barn Swallow, Red-Winged Blackbird and Common Grackle

Nesting parameters under investigation were:

- nesting density
- clutch initiation
- clutch size
- rate of weight gain by nestlings
- rate of bone growth by nestlings as measured by tarsus-metatarsus length
- egg porosity as measured by water loss (weights)
- egg size decrease

Examination of stomach contents from selected young made to determine species of aquatic insect most often fed.

ANTICIPATED RESULTS: Determination whether any of the observed nesting parameters is correlated with pH.

Evidence for prey selection in feeding of young.

SUBJECT CODE: 3.2.5

PROJECT NUMBER: 357

TITLE: Lake Acidification and Heavy Metal, Al Levels in Aquatic Insect Prey of Passerine Birds, Killarney Provincial Park, Ontario

PRINCIPAL INVESTIGATOR'S NAME: V. Glooschenko

AGENCY AND DEPARTMENT: Ministry of Natural Resources, Wildlife Branch

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PHONE: (416) 965-7641

COOPERATING AGENCIES AND INVESTIGATORS:

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Dr. John Lott
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DURATION OF EACH PHASE: Method development: July - Sept., 1982
Electron microscopy and Edax: Dec., 1982 - Feb., 1983
Sample preparation and analysis: Oct. - Dec., 1982

APPROXIMATE COST:

OBJECTIVES:

1) Assess the aquatic food base of passerine birds within Killarney Provincial Park, an area of pH-stress.

2) Provide quantitative estimation of heavy metals, Al levels in aquatic insect prey which might affect passerine reproduction.

3) Refine and intercompare methodology for this work.

METHOD:

- Taxonomy, aquatic insects collected from emergence traps.
- Atomic absorption spectrometry methods refined for Al analyses of aquatic insects commonly used as prey by passerines.
- Standard electron micrograph and energy dispersive analysis of x-ray (Edax) technique.

ANTICIPATED RESULTS: Comparison of results with European data:

1) acidification effects on heavy metal, Al levels in passerine aquatic insect prey,
2) kingbird egg porosity under various pH-stress regimes,
3) determination of whether any observed impairment of passerine reproduction may be linked to insect prey contaminants.

PROJECT NUMBER: 358

SUBJECT CODE: 3.2.5

TITLE: The Effect of Acidic Precipitation on the Productivity of Common Loons (*Gavia immer*) in the Sudbury-Manitoulin Region

PRINCIPAL INVESTIGATOR'S NAME: D. K. McNicol
R. K. Ross

AGENCY AND DEPARTMENT: Department of the Environment, Canadian Wildlife Service

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COOPERATING AGENCIES AND INVESTIGATORS: Long Point Bird Observatory (R. Alvo)
Ontario Ministry of Natural Resources
Ontario Ministry of Environment

DURATION OF EACH PHASE:

APPROXIMATE COST: 1983-84
(B Base funds)
$10K

OBJECTIVES: To determine if correlations exist between the effects of acidic precipitation and the productivity of Common Loons breeding in a heavily impacted area.

METHOD: During the summer of 1982, a pilot study was conducted by Long Point Bird Observatory in the Sudbury-Manitoulin region. Water chemistry data and records of loon presence and productivity were collected on 84 lakes during 2 visits. Lakes representing all 5 MOE lake sensitivity classes, ranging from acidified ($pH < 4.5$) to unaffected ($pH > 8.0$), were studied. Common Loon productivity measurements were based on observations of adults, nests and eggs as well as brood number and size taken during June to August 1982.

During the 1983-84 period, a continuation of the Common Loon study in the Sudbury area is proposed. Data on water chemistry and loon presence and productivity will again be assessed on 80-100 lakes, increasing the sample size of lakes in certain sensitivity categories. Historical fisheries information from the Ontario Ministry of Natural Resources will be used in the selection of study lakes where available.

ANTICIPATED RESULTS: The completion of a report outlining the results of the 1982 field season is anticipated by December 31, 1982. Preliminary results suggest that common loon productivity is reduced on acidic and extremely sensitive lakes. Work in 1983 will document this relationship further and investigations will be initiated to determine how loons are responding to the acidification of a large number of lakes in the area.

SUBJECT CODE: 3.2.5

PROJECT NUMBER: 359

TITLE: Selenium Concentrations in Wild Herbivore Feedstocks of Eastern Canada

PRINCIPAL INVESTIGATOR'S NAME: George G. Shaw

AGENCY AND DEPARTMENT: Canadian Wildlife Service, DOE

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T5K 2J5

PHONE: (403) 435-7355

COOPERATING AGENCIES AND INVESTIGATORS:
C. Dauphiné, CWS (Ontario)
C. Drolet/P. LaPorte, CWS (Quebec)
W. Prescott, CWS (New Brunswick)

DURATION OF EACH PHASE: 3 successive years starting 1983-84.

APPROXIMATE COST: Year 1 - $24K, Year 2 - $16K, Year 3 - $11K

OBJECTIVES:

a) To determine the present concentrations of selenium in the diet of moose (*Alces alces*) in eastern Canada.

b) To provide the scientific basis for comparing average concentration of selenium in the same diets 2 decades from now.

METHOD: Terminal leaves on leaders of *Populus tremuloides*, *Betula papyrifera* and *Acer spicatum* would be sampled in early July after leaf size development is completed at 6 locations in eastern Canada. At these same locations the terminal leaders of these species and *Abies balsamea* would be resampled in February. This bi-annual sampling would continue for 3 consecutive years to get an estimate of seasonal variability in plant selenium concentration as measured by hydride generation or automated fluorimetry. The sampling locations have been chosen already because moose inhabit the areas, road accessibility is good, and are near known air quality monitor stations of the CANSAP and APN system. The locations have similar podsolic soils and soil climate regimes are in low to moderate range for SO_4 concentration in rainfall, and are within provincial or national park boundaries. Ten to 15 sampling sites within each location will be selected by using clear cut and forest fire maps.

ANTICIPATED RESULTS: The average concentration of selenium in 3 or 4 major foods for moose during late spring and winter will be determined for eastern Canada. Measures of between location and within location variability and seasonal variability in average selenium concentration for each food plant will also be determined. Low concentrations (20 ppb) would be consistent with the livestock forage results reported by various authors for eastern Canada as summarized by Shaw (Proc. 38th NE Fish and Wildl. Conf. 1981).

Samples of plant material stored in the CWS tissue bank will be available a decade from now for comparison with samples taken then from the same sites and locations (permanently marked). A decrease in selenium concentration over the 10 year period might be related to the increased S loading expected for eastern forests during this time. Such a result would be similar to that reported to occur in Danish livestock forages from 1964-73 (Gissel-Nielsen Acta Agric. Scand. (25) 1975).

PROJECT NUMBER: 360

SUBJECT CODE: 3.2.6

TITLE: Lichen Response to Sulphur Dioxide

PRINCIPAL INVESTIGATOR'S NAME: M. S. Kotturi

AGENCY AND DEPARTMENT: Ministry of Environment/Air Studies Branch

ADDRESS: Air Studies Branch
Ministry of Environment
Parliament Buildings
Victoria, British Columbia
V8V 1X5

PHONE: (604) 387-5888

COOPERATING AGENCIES AND INVESTIGATORS: Terrestrial Studies Branch
Ministry of Environment
J. Van Barneveld

DURATION OF EACH PHASE: 04/80 to 08/83

APPROXIMATE COST: $5K

OBJECTIVES: Use of Lichen to monitor the impact of industrial emissions.

METHOD: Twenty lichen monitoring sites in the vicinity of a new natural gas processing plant have been established in 1980, prior to construction of the plant. Sampling will be a repeat in the spring of 1983 to evaluate the effect of ambient SO_2 on the lichen.

ANTICIPATED RESULTS: Preliminary results will be published by the end of 1983.

SUBJECT CODE: 3.2.6

PROJECT NUMBER: 361

TITLE: Regional Bioindicator Studies: Trace Metals in Lichen in New Brunswick

PRINCIPAL INVESTIGATOR'S NAME: A. J. Spavold

AGENCY AND DEPARTMENT: Environmental Services Branch

ADDRESS: Environment New Brunswick
P.O. Box 6000
Fredericton, New Brunswick
E3B 5H1

PHONE: (506) 453-2669

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: 1977 - indefinite

APPROXIMATE COST: $30K/1982

OBJECTIVES:
- assessment of background loadings of trace metals in lichens and other vegetation in New Brunswick;
- determination of relative contributions of local pollution sources and LRTAP to trace metal bio-accumulation.

METHOD:
- data obtained annually as part of sampling done for Regional Bioindicator Study Networks;
- survey of areas isolated from local pollution sources;
- trace metals analyzed include Cd, Cr, Cu, Fe, Ni, Pb, V, Ti and Hg.

ANTICIPATED RESULTS: Data stored on Environment New Brunswick data storage system. Technical Reports to be issued after internal review.

PROJECT NUMBER: 362

SUBJECT CODE: 3.2.6

TITLE: Epiphyte Monitoring Programme, District of Thunder Bay

PRINCIPAL INVESTIGATOR'S NAME: Dr. H. Dennis Griffin

AGENCY AND DEPARTMENT: Ontario Ministry of the Environment

ADDRESS: P.O. Box 5000
Thunder Bay, Ontario
P7C 5G6

PHONE: (807) 475-1215

COOPERATING AGENCIES AND INVESTIGATORS:

Contractor:	Cooperating Agency:
Dr. Paul Barclay	Phytotoxicology Section
Biology Department	Air Resources Branch
Lakehead University	Ontario Ministry of the Environment
Thunder Bay, Ontario	
P7B 5E1	(Dr. S. N. Linzon)

DURATION OF EACH PHASE: Preliminary work undertaken in 1981, with completion of sampling for chemical analysis scheduled for 1983.

APPROXIMATE COST: $4,000 (1/4/82 - 31/3/83)

OBJECTIVES: Determine concentrations of selected chemical constituents of lichens and mosses sampled in 1970-71 in the District of Thunder Bay and compare with data from repeat sampling from the same sites in 1981-83.

METHOD: Lichens and mosses will be collected from approximately 36 sites originally sampled in 1970-71. Both old and new sets of sample material will be submitted for chemical analysis.

ANTICIPATED RESULTS: This study should reveal changes, if any, which have occurred over a period of approximately 10 years in some chemical constituents of commonly-occurring lichens and mosses.

SUBJECT CODE: 3.2.7

PROJECT NUMBER: 363

TITLE: Vegetation Stress Assessment in the Vicinity of the Syncrude Oil Sands Development

PRINCIPAL INVESTIGATOR'S NAME: Dr. T. S. Dai

AGENCY AND DEPARTMENT: Environmental Affairs, Syncrude Canada Ltd.

ADDRESS: 10030 - 107 Street
Edmonton, Alberta
T5J 3E5

PHONE: (403) 429-9313

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: 30 years with next photograph to be taken in 1984.

APPROXIMATE COST:

OBJECTIVES: Evaluation of vegetation stress in the Syncrude Oil Sands leases and surrounding areas with special attention on the possible stress caused by air pollution.

METHOD: Syncrude operations have been continuously producing considerable amounts of SO_2 and other gaseous materials to the air. The Company, governments and the public are all concerned with these potentially harmful materials and their effects on the natural ecosystems. For this reason, Syncrude has initiated an aerial photography program to document the vegetation changes in the project and surrounding areas. In 1974 and 1978, aerial photographs of the vegetation were taken using false-color infrared film, which records differences in plant stress. It is planned to photograph the same area at approximately 6 year intervals over the life of the project.

ANTICIPATED RESULTS:

PROJECT NUMBER: 364

SUBJECT CODE: 3.3

TITLE: Kejimkujik Calibrated Basin Monitoring Network

PRINCIPAL INVESTIGATOR'S NAME: T. L. Pollock

AGENCY AND DEPARTMENT: Water Quality Branch, IWD, Environment Canada

ADDRESS: P.O. Box 861
Moncton, New Brunswick
E1C 8N6

PHONE: (506) 388-6606

COOPERATING AGENCIES AND INVESTIGATORS: CWS-AR

DURATION OF EACH PHASE: 1983-86

APPROXIMATE COST: 83 - 84 - $20K

OBJECTIVES: To determine the ability and capacity of a marine, bog dominated ecosystem to withstand contamination due to LRTAP and to develop rates of response to changes in atmospheric loadings.

METHOD: Analyzing water samples collected from selected sites in the basin. To characterize the hydrogen ion, "alkalinity", sulphate, nitrate and carbon in the surface waters of interest under the various annual hydrologic conditions.

ANTICIPATED RESULTS: Completion of the analyses for the final water year of intensive sampling. To supply analytical data for a suitable hydrologic model for response of the Basin to changes in atmospheric loading. To forward data to NAQUADAT. To contribute data to final Kejimkujik Basin Study Report.

SUBJECT CODE: 3.3

PROJECT NUMBER: 365

TITLE: Salmon Watershed Physical-Chemical Surveys in Nova Scotia (Project C4)

PRINCIPAL INVESTIGATOR'S NAME: H. E. Hirvonen

AGENCY AND DEPARTMENT: Lands Directorate

ADDRESS: 45 Alderney Drive
Dartmouth, Nova Scotia
B2Y 2N6

PHONE: (902) 426-4196

COOPERATING AGENCIES AND INVESTIGATORS:
N.S. Dept. of Forestry
DFO Atlantic Region
IWD Atlantic Region

DURATION OF EACH PHASE:

APPROXIMATE COST: Proposed $40,000 O&M and 0.3 PY (1983/84) (includes $25,000 for contractor salary).

OBJECTIVES:

- To investigate soil geochemical interactions in selected and heavily impacted salmon watersheds in southern Nova Scotia.
- To develop effective understanding of terrestrial/aquatic ecosystem interactions.
- To complement parallel studies on soil geochemical LRTAP processes in Ontario and Quebec regions.

METHOD:

ANTICIPATED RESULTS: Compilation of existing data, field survey on soil ecosystem for 1983/84, initial report on evaluations and development of model.

RELEVANCE: Complement parallel studies by Lands staff in Ontario and Quebec regions. Project is designed to provide a set of baseline studies on LRTAP- soil interactions, to complement existing studies in other agencies, and to respond directly to MOI research needs.

PROJECT NUMBER: 366

SUBJECT CODE: 3.3

TITLE: The Influence of Watershed Characteristics in Determining Lake pH

PRINCIPAL INVESTIGATOR'S NAME: Dr. G. L. Vascotto (acting)

AGENCY AND DEPARTMENT: Ontario Hydro, Biological Research Section, KD118

ADDRESS: 800 Kipling Avenue
Toronto, Ontario
M8Z 5S4

PHONE: (416) 231-4111
Ext. 6865

COOPERATING AGENCIES AND INVESTIGATORS: Dr. N. M. Hooper-Reid

DURATION OF EACH PHASE: Phase I - Complete May 1982
Phase II - December 1983

APPROXIMATE COST: Phase II - $45K

OBJECTIVES: To identify the watershed related variables responsible for the variability in pH observed in lakes of a region.

METHOD:

1. Collect geological, morphometrical, botanical and land use data for 210 cambrian shield lakes.
2. Categorize lakes by acidity and deposition categories.
3. Identify watershed characteristics associated with acid/non-acid lakes.

ANTICIPATED RESULTS: A better understanding of the role of watershed characteristics as determining factors of the acid sensitivity of lakes.

SUBJECT CODE: 3.3

PROJECT NUMBER: 367

TITLE: Physical-Chemical Evaluation of Quebec Watersheds (Project C3)

PRINCIPAL INVESTIGATOR'S NAME: J. L. Belair
G. Gilbert

AGENCY AND DEPARTMENT: Lands Directorate

ADDRESS: C.P. 10 100
Ste-Foy, Quebec
G1V 4C7

PHONE: (418) 694-3964

COOPERATING AGENCIES AND INVESTIGATORS: IWD Quebec Region
Quebec Dept. Energy and Resources

DURATION OF EACH PHASE:

APPROXIMATE COST: Proposed $78,000 and 1.0 PY in 1983-84 (includes $30,000 for contractor salary)

OBJECTIVES: To provide detailed ecological description and evaluation of selected watershed in Quebec to permit effective integration of terrestrial and aquatic data sets.

METHOD:

- To develop an integrated ecosystem model for LRTAP sensitivity assessment.
- To complement parallel studies on related ecosystems by Ontario and Quebec Lands staff.

ANTICIPATED RESULTS:

- Compilation of existing data and newly interpret data to provide an effective, integrated computerized data base for assessments.
- Initial report on ecosystem LRTAP impact modelling.

RELEVANCE: Project is designed as an effective complement to pilot research on soil-geochemical interactions initiated in Ontario region during 1982-83 and in response to stated MOI research needs. Quebec region may be more heavily impacted than Ontario region but ecosystem LRTAP impact studies in the province lag far behind initiatives in Ontario.

PROJECT NUMBER: 368

SUBJECT CODE: 3.3

TITLE: Mersey River Basin Study

PRINCIPAL INVESTIGATOR'S NAME: T. A. Clair

AGENCY AND DEPARTMENT: Water Quality Branch, IWD, Environment Canada

ADDRESS: P.O. Box 861
Moncton, New Brunswick
E1C 8N6

PHONE: (506) 388-6606

COOPERATING AGENCIES AND INVESTIGATORS: Parks Canada, NWRI

DURATION OF EACH PHASE: 1983-84

APPROXIMATE COST: $20K O&M $5K Cap

OBJECTIVES: Contributes to ECS Objective 1 b. through the study of a S.W. Nova Scotia ecosystem to quantify pathways and to define cause-effect relationships from which predictive models of ecosystem effects can be developed and verified.

METHOD: The Upper Mersey River Basin, a well-defined, calibrated basin of 300 km^2 area will be gauged and water samples taken periodically at two sites from November 1st, 1983 to April 30th, 1984. Also sampled will be precipitation and snowpack chemistry and soil porosity. Calculations of the contaminant load of the snowpack (H, $SO_4^=$, NH_3, NO_2^- & NO_3^-) will be done before and after melt events.
River quality will be predicted based on the input of contaminants and water discharge.

ANTICIPATED RESULTS: Reports detailing the results will be published and data produced for input into a hydrologic model being developed at NWRI. The results will provide information on snowpack contamination concentrations, necessary for determining "allowable" precipitation contamination levels in southwestern Nova Scotia.

SUBJECT CODE: 3.3

PROJECT NUMBER: 369

TITLE: LRTAP Monitoring Network

PRINCIPAL INVESTIGATOR'S NAME: T. A. Clair

AGENCY AND DEPARTMENT: Water Quality Branch, IWD, Environment Canada

ADDRESS: P.O. Box 861
Moncton, New Brunswick
E1C 8N6

PHONE: (506) 388-6606

COOPERATING AGENCIES AND INVESTIGATORS: Water Resources Branch, IWD, Environment Canada

DURATION OF EACH PHASE: Ongoing

APPROXIMATE COST: $55K O&M $2K Cap

OBJECTIVES: To fulfill the MOI objectives of monitoring sensitive areas for trends in water quality.

METHOD:

1) Twelve rivers will be sampled monthly and every two weeks during the January to May periods as part of a long-term trend assessment study.

2) The network will be expanded to include a number of lakes in southwest Nova Scotia which will be sampled at spring and fall turnovers to monitor any long-term trends.

3) Groundwater monitoring sites will be installed and sampled based on recommendations of the IWD groundwater discussion group.

ANTICIPATED RESULTS: Data which can be used in long-term assessment and reports describing results. Data which will address the question of speciation of metals and the effect of acidic precipitation on the trace metal content of surface and groundwaters.

PROJECT NUMBER: 370

SUBJECT CODE: 3.3

TITLE: Watershed Acidification Models

PRINCIPAL INVESTIGATOR'S NAME: D.C.L. Lam

AGENCY AND DEPARTMENT: Department of Environment, National Water Research Institute

ADDRESS: Canada Centre for Inland Waters
P.O. Box 5050
Burlington, Ontario
L7R 4A6

PHONE: (416) 637-4235

COOPERATING AGENCIES AND INVESTIGATORS: Fisheries and Oceans
Canadian Forestry Service

DURATION OF EACH PHASE: Reviewed on an annual basis.

APPROXIMATE COST:

OBJECTIVES:

1. To integrate watershed data, define the pathways leading to surface or groundwater systems and to calibrate known chemical equilibrium equations in aquatic regimes, particularly the carbon and sulphur cycles.
2. To develop the hydro-geochemical acidification and water quality model components affecting the pH, alkalinity and major ions; inclusion of atmospheric loads and run-off-rainfall submodels; feed-backs to experimental projects.

METHOD:

REVELANCE: The ability to model the basic relationships of atmospheric loading to basin hydrological regime response is fundamental to the management of water quality as related to atmospheric deposition.

ANTICIPATED RESULTS: It is expected that a first generation watershed acidification model will be developed by March 1984.

SUBJECT CODE: 3.3

PROJECT NUMBER: 371

TITLE: Biological Production, Community Structure and Success in a Calibrated Watershed

PRINCIPAL INVESTIGATOR'S NAME: Dr. John R. M. Kelso

AGENCY AND DEPARTMENT: Department of Fisheries and Oceans

ADDRESS: Great Lakes Fisheries Research Branch
1219 Queen Street East
Sault Ste. Marie

PHONE: (705) 942-2848

COOPERATING AGENCIES AND INVESTIGATORS: National Water Research Institute, Atmospheric Environment Service, National Hydrologic Research Institute, Great Lakes Forest Research Institute, Fisheries Research Branch, Ontario Ministry of Natural Resources, Universities on contract.

DURATION OF EACH PHASE: 3 years operational, 1 year data analyses, 2 year model testing (could include system manipulation/alteration) = 6 years.

APPROXIMATE COST:

81/82	82/83	83/84
122.5K	122.5K	115.5K

OBJECTIVES: Through operation of a calibrated watershed, determine the response of an aquatic system to moderate - high loading (AES) by
(a) budgeting major ion chemistry and hydrology (NWRI)(NHRI);
(b) determining effect of inputs on terrestrial system and influence of terrestrial system on the input (GLFRI);
(c) determine biological state and response and effect on early life history of fish (DFO and OMNR).

METHOD: In a lake system having lakes ranging from a pH sensitive headwater lake to a downstream better buffered lake, determine inputs from the atmosphere (AES) and the groundwater contribution to lake chemistry and hydrology (NHRI); create a chemical/hydrological budget (NWRI) by monitoring water flow and water chemistry; determine biological community and production in relation to lake chemistry in each lake (DFO); determine factors influencing fish well-being and production in relation to lake chemistry in each lake (DFO); determine factors influencing fish well-being and production in each lake; determine success of fish early life history in the lakes of various pH and buffer states. Biological studies in 4 lakes ranging from acidic to pH susceptible. Fish communities range from none to mixed brook trout/lake trout.

ANTICIPATED RESULTS:

1. Determination of rate of change in an aquatic system as a result of LRT.
2. Characterization of biological response to lake acidic state.
3. Identification of factors, particularly heavy metals influenced by buffer state which influence biological state.
4. Identification of the symptoms in biological communities that appear from stresses resulting from low pH and/or decreased buffer state.

PROJECT NUMBER: 372

SUBJECT CODE: 3.3

TITLE: Mediation Effects of a Watershed on Atmospheric Deposition

PRINCIPAL INVESTIGATOR'S NAME: J.R.M. Kelso and M. G. Johnson

AGENCY AND DEPARTMENT:

J.R.M. Kelso
Dept. of Fisheries & Oceans

M. G. Johnson
Dept. of Fisheries & Oceans

ADDRESS:

Great Lakes Fish. Res. Br.
1219 Queen Street East
Sault Ste. Marie, Ontario
(705) 942-2848

Great Lakes Fish. Res. Br.
1180 20th Street East
P.O. Box 969
Owen Sound, Ontario
(519) 371-0040

COOPERATING AGENCIES AND INVESTIGATORS: J. McLean, G. Beggs, O.M.N.R.

DURATION OF EACH PHASE: 81-84

APPROXIMATE COST:

81/82	82/83	83/84
	35K	?

OBJECTIVES:

1. To determine how effects of atmospheric deposition are mediated through a watershed by lake order, flow, watershed area and by terrain characteristics such as bog, forest cover and exposed bedrock.
2. Determine, at least in part, how these watershed features are reflected in the fishery in terms of community structure and body burdens of at least Hg and Pb.

METHOD:

1. 1982/83 is to be viewed as a feasibility study.
2. Order all lakes and streams, determine lake areas and watershed areas, measure stream discharge and lake outflows where possible, sample lakes/streams for DOC, pH, alk, cond, Cd, Mg, SO_4, Al, total P, total N.
3. Determine from maps/photos terrain characteristics.
4. Determine fish community structure in a subset of lakes and yield within the watershed.

ANTICIPATED RESULTS:

1. Validation (?) of the DFO regional model and the Hough, Standsbury and Michalski model within at least 2 watersheds.
2. Assessment of the value of the scaling factors and watershed features.
3. Partial assessment of body accumulation of at least 2 metals exacerbated by acidification.

CODE DU SUJET: 3.3

NUMÉRO DE PROJET: 373

TITRE: Bilan hydrologique du bassin du Lac Laflamme

NOM DU CHERCHEUR RESPONSABLE: André P. Plamondon

MINISTÈRE, ORGANISME OU ORGANISME PRIVÉ, SERVICE: Département d'aménagement et de sylviculture, Faculté de foresterie et de géodésie

ADRESSE: Université Laval
Pavillon Vachon - Bureau 0868
Ste-Foy, Québec
G1K 7P4

TÉLÉPHONE: (418) 656-7120

COLLABORATEUR(S), ORGANISME(S) ET CHERCHEUR(S): Financé par Environnement Canada
Direction générale des eaux

DURÉE DE CHAQUE PHASE: 1980 - 1983

COÛT APPROXIMATIF: De 1980 - 1983: $95K

OBJECTIFS DE TRAVAIL: Quantifier chaque élément du cycle hydrologique sur le bassin du Lac Laflamme (précipitation, interception, écoulement le long du fût, fonte de la neige, flux d'eau dans la matière organique et dans le sol minéral jusqu'à la nappe phréatique)

MÉTHODE DE TRAVAIL: Mesure des divers paramètres sur un versant durant deux années entières.

Distribution spatiale de la précipitation, interception.

RÉSULTATS PRÉVUS: Bilan détaillé sur un versant.

Evaluation du bilan sur l'ensemble du bassin.

PROJECT NUMBER: 374

SUBJECT CODE: 3.3

TITLE: An Acidification Index for Nova Scotia Surface Waters

PRINCIPAL INVESTIGATOR'S NAME: Dr. Hague H. Vaughan

AGENCY AND DEPARTMENT: Nova Scotia Department of the Environment

ADDRESS: P.O. Box 2107
Halifax, Nova Scotia
B3J 3B7

PHONE: (902) 424-5300

COOPERATING AGENCIES AND INVESTIGATORS:
J. Underwood, Nova Scotia Department of the Environment
B. Sabean, Nova Scotia Lands and Forests
D. Peterson, Fisheries and Oceans,
St. Andrews, N.B.

DURATION OF EACH PHASE: 9/81 - 3/83

APPROXIMATE COST: 9/81-3/83 $5,000 (excluding salaries)

OBJECTIVES: Development and testing of an index to allow comparison of the response of watersheds to LRTAP and local emission sources. The index must be capable of allowing for natural sources of acidity (organic acids, $SO_4^=$ from soils and bogs) and sensitive to the dilute nature of N.S. surface waters.

METHOD:

- Literature review and synthesis.
- Greatly expanded data base incorporating complete analyses of metals and critical examination of the accuracy of SO_4 & TOC measurements.
- Use of this data base to develop and test the hypothetical model of N.S. watershed acidification: development of an index.
- Testing of the potential for calibration of this index by means of the study of the response of specific lakes through diatom analyses.

ANTICIPATED RESULTS: A tool which is as useful as the CSI or Henriksen model should be, but which considers and is designed for the particular nature of N.S. surface waters for which the above prove inadequate. Back-ground information in Underwood, Vaughan, Ogden and Mann (1982) Acidification of Nova Scotia Lakes II: Ionic balances in dilute lakes. NSDOE report.

SUBJECT CODE: 3.3

PROJECT NUMBER: 375

TITLE: An Assessment of Watershed-Lake Chemistry Relationships in the Greater Sudbury Area

PRINCIPAL INVESTIGATOR'S NAME: J. Roger Pitblado

AGENCY AND DEPARTMENT: Department of Geography

ADDRESS: Laurentian University
Sudbury, Ontario
P3E 2C6

PHONE: (705) 675-1151
Ext. 666
or 384

COOPERATING AGENCIES AND INVESTIGATORS: Contract work for the Sudbury Office of the Ontario Ministry of the Environment (Contact: W. Keller).

DURATION OF EACH PHASE: 06/82 - 09/82

APPROXIMATE COST: 06/82 - 09/82 Est. $6,000

OBJECTIVES:

1. To develop a methodology for measuring watershed characteristics from existing terrain maps that can be related to selected lake chemistry variables: pH, conductivity, alkalinity, Ca, Mg.
2. To develop empirical, mathematical models for predicting the quantitative values of the lake chemistry variables listed above, with special attention focused on alkalinity.
3. To determine which watershed factors have the greatest relative effect or influence on the selected lake chemistry characteristics.
4. To assess the value of the derived models for regional evaluation of lake acidification in northeastern Ontario.

METHOD: Multiple regression analysis.

ANTICIPATED RESULTS: Multiple regression analysis of the data that has been acquired to date enables one to predict alkalinity, conductivity, Ca and Mg with a relatively high degree of success; pH is much more difficult to predict using these methods.

PROJECT NUMBER: 376

SUBJECT CODE 3.4

TITLE: The Effect of Acid Rain on the Eye

PRINCIPAL INVESTIGATOR'S NAME: Dr. P. K. Basu

AGENCY AND DEPARTMENT: Department of Ophthalmology, University of Toronto

ADDRESS: 1 Spadina Crescent
Toronto, Ontario
M5S 2J5

PHONE: (416) 978-2635

COOPERATING AGENCIES AND INVESTIGATORS: Water Resources Branch, Ministry of the Environment
Government of Ontario
Department of Supply and Services
Canada and Health Protection Branch
Environmental Health, Canada

DURATION OF EACH PHASE: Nov 1981 - Sept 1982

APPROXIMATE COST: $31K

OBJECTIVES: To determine if exposure of eyes to water from an acidic lake harms the cornea and conjunctiva.

METHOD: One eye of a rabbit was exposed to a water sample from an acidic lake (pH 5.2, 5.0, 4.7 or 4.5). The other eye of the same rabbit was exposed to a water sample from a lake having a near neutral pH (6.2 or 6.4). The conjunctival and corneal reactions of the two eyes were compared using many clinical and laboratory tests.

ANTICIPATED RESULTS: It appears that in general water from acidic lakes has no significant harmful effect on healthy rabbit eyes in terms of the test parameters used.

SUBJECT CODE: 3.4

PROJECT NUMBER: 377

TITLE: Health Effects of Sulphur - Containing Emissions (Inhalation Toxicology)

PRINCIPAL INVESTIGATOR'S NAME: Dr. M. G. Prior

AGENCY AND DEPARTMENT: Toxicology Group, Animal Sciences Wing

ADDRESS: Alberta Environmental Centre
Vegreville, Alberta

PHONE: (403) 632-6767

COOPERATING AGENCIES AND INVESTIGATORS: Workers' Health, Safety and Compensation Board

DURATION OF EACH PHASE: Commenced April 1981

APPROXIMATE COST: $160,676 (82-83)

OBJECTIVES: This study will examine, in vivo, the effects of acute, sub-acute, and chronic inhalation exposures of hydrogen sulphide, sulphur dioxide, and other gases on laboratory rodents and other species. Estimates of the toxic effects on animals and, by extrapolation, on man will be made. Standard and specialized biochemical, physiological, immunological and cellular toxicological assays of pulmonary toxicity will be developed.

METHOD: Contact principal investigator for project methodology.

ANTICIPATED RESULTS: Initial results can be obtained from the Toxicology Group, Animal Sciences Wing, Alberta Environmental Centre.

PROJECT NUMBER: 378

SUBJECT CODE: 3.4

TITLE: The Effects of Acid Precipitation on Drinking Water Quality in Southern New Brunswick

PRINCIPAL INVESTIGATOR'S NAME: Jane Bell
W. C. Ayer

AGENCY AND DEPARTMENT: Environmental Services Branch and Pollution Control Branch
Environment New Brunswick

ADDRESS: P.O. Box 6000
Fredericton, New Brunswick
E3B 5H1

PHONE: (506) 453-2669

COOPERATING AGENCIES AND INVESTIGATORS: Dalhousie University, Halifax, N.S.

DURATION OF EACH PHASE: 1982 - data collection
1983 - data analysis

APPROXIMATE COST: $4,000

OBJECTIVES:

- To determine the water quality of drinking water from various sources in southern New Brunswick.
- To determine the relationship between the chemistry of the drinking water source and the potential for trace metal concentration with respect to time.
- To determine whether a decrease in the pH of the various water supplies has occurred.

METHOD:

- Collections of source and tap water with respect to time and analysis for pH, chlorine, Cd, Pb, Zn, Cu and other parameters.

ANTICIPATED RESULTS:

- M.Sc. thesis and technical report.

SUBJECT CODE: 3.4

PROJECT NUMBER: 379

TITLE: Development of Pollution Monitoring Devices

PRINCIPAL INVESTIGATOR'S NAME: J. C. Meranger and T. A. Khan

AGENCY AND DEPARTMENT: National Health and Welfare, Bureau of Chemical Hazards

ADDRESS: Tunney's Pasture
Ottawa, Ontario
K1A 0L2

PHONE: (613) 992-1388

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: Ongoing

APPROXIMATE COST: $40K + $40K

OBJECTIVES: To develop, build and test monitoring equipment designed for use in the determination of personal exposures to indoor/outdoor concentration levels of nitrogen and sulfur oxides, and particulate matter.

METHOD: Refine existing technology and develop new concepts where necessary to meet specific requirements.

ANTICIPATED RESULTS: The development and use of these apparatus will simplify pollutant measurements and improve their accuracy. They will also assist in determining personal exposure to NO_X, SO_X and particulates.

PROJECT NUMBER: 380

SUBJECT CODE: 3.4

TITLE: Evaluation of the Direct Health Effects Associated with LRTAP

PRINCIPAL INVESTIGATOR'S NAME: Dr. H. S. King

AGENCY AND DEPARTMENT: National Health and Welfare, Bureau of Chemical Hazards

ADDRESS: Tunney's Pasture
Ottawa, Ontario
K1A 0L2

PHONE: (613) 593-5887

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: Continuing

APPROXIMATE COST:

OBJECTIVES:

1) To determine the effects of air-borne, acid forming pollutants on human morbidity and mortality.

2) To monitor on a continuing basis the health status of selected groups.

METHOD: Epidemiological studies will be conducted in selected regions of Canada. Respiratory evaluations will be conducted in concert with the epidemiological studies and appropriate monitoring data.

ANTICIPATED RESULTS: Health responses to environmental conditions will be measured. The impact of LRTAP on human health will be assessed.

SUBJECT CODE: 3.4

PROJECT NUMBER: 381

TITLE: Identification and Monitoring of Pollutants in an Area Receiving Acidic Deposition

PRINCIPAL INVESTIGATOR'S NAME: J. C. Meranger and T. Khan

AGENCY AND DEPARTMENT: National Health and Welfare, Bureau of Chemical Hazards

ADDRESS: Environmental Health Centre
Tunney's Pasture
Ottawa, Ontario

PHONE: (613) 992-3388

COOPERATING AGENCIES AND INVESTIGATORS: St. Francis Xavier University
Antigonish, Nova Scotia

DURATION OF EACH PHASE: Complete by 1983

APPROXIMATE COST:

OBJECTIVES: Identification of the types of sulfur and nitrogen compounds present in ambient air in regions of acidic deposition.

Investigation and monitoring of a selected population to their exposures to sulfur and nitrogen oxides using personal and site samples.

METHOD: Identification of pollutant species completed by contract. Monitoring of the selected population is to be conducted by researchers with the cooperation of individuals within the community utilizing established technology and recently developed methods.

ANTICIPATED RESULTS: The completion of the contract will provide us with information on the types of species of sulfur and nitrogen compounds present in ambient air in regions of acidic deposition. The monitoring segment will assist in the assessment of personal exposure to sulfur and nitrogen compounds and possibly the associated health effects.

PROJECT NUMBER: 382

SUBJECT CODE: 3.4

TITLE: Compilation of Pollution Monitoring Data

PRINCIPAL INVESTIGATOR'S NAME: Dr. P. Toft

AGENCY AND DEPARTMENT: National Health and Welfare, Bureau of Chemical Hazards

ADDRESS: Tunney's Pasture
Ottawa, Ontario
K1A 0L2

PHONE: (613) 992-0891

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: Completed in 1982.

APPROXIMATE COST:

OBJECTIVES: Evaluate the usefulness of existing Canadian air monitoring data for estimating time exposure to regulated air pollutants.

Summarize reports dealing with time and human acitivity patterns.

METHOD: Obtain all published pertinent information from relevant agencies and evaluate.

ANTICIPATED RESULTS: The final report should contribute additional information that will assist in the determination of total human exposure to air pollutants.

SUBJECT CODE: 3.4

PROJECT NUMBER: 383

TITLE: Indoor Air Quality

PRINCIPAL INVESTIGATOR'S NAME: Dr. D. Pengelly

AGENCY AND DEPARTMENT: McMaster University

ADDRESS: 1280 Main Street West, Room 526
Hamilton, Ontario

PHONE:

COOPERATING AGENCIES AND INVESTIGATORS:
1) National Health and Welfare, Bureau of Chemical Hazards
2) World Health Organization

DURATION OF EACH PHASE: Contract complete by February 1983

APPROXIMATE COST: $91K

OBJECTIVES:
1) To provide data on indoor air pollutants in Hamilton, Ontario and to compare indoor/outdoor concentration ratios.
2) Determine the effectiveness of data obtained with personal samples.

METHOD: Design and validate a pollutant monitoring network for SO_2, NO_2 and suspended particulates.

Integrate the results with an ongoing epidemiological study of the respiratory health of local school children.

ANTICIPATED RESULTS: A simplified personal monitor should be developed and the respiratory health of children in different pollution regions will be assessed.

PROJECT NUMBER: 384

SUBJECT CODE: 3.4

TITLE: Evaluation of the Health Effects of Air Pollution on Asthmatics

PRINCIPAL INVESTIGATOR'S NAME: Dr. F. Silverman

AGENCY AND DEPARTMENT: Gage Research Institutes

ADDRESS: 233 College Street
Toronto, Ontario
M5T 1R4

PHONE:

COOPERATING AGENCIES AND INVESTIGATORS: National Health and Welfare
Bureau of Chemical Hazards

DURATION OF EACH PHASE: Completed

APPROXIMATE COST: $60K

OBJECTIVES: 1) To provide data on levels of pollutants in the total environment of selected asthmatics.

2) To examine daily health effects of pollution on documented asthmatic patients and a group of healthy subjects.

METHOD: Design and implement a prospective epidemiological study.

Integrate health effects study with ongoing environmental monitoring.

ANTICIPATED RESULTS: Any association between air pollution and the health of susceptible individuals should become evident.

SUBJECT CODE: 3.4

PROJECT NUMBER: 385

TITLE: Investigation of Drinking Water Sources in Areas Susceptible to Acidic Precipitation

PRINCIPAL INVESTIGATOR'S NAME: V. A. Armstrong

AGENCY AND DEPARTMENT: National Health and Welfare, Bureau of Chemical Hazards

ADDRESS: Tunney's Pasture
Ottawa, Ontario
K1A 0L2

PHONE: (613) 992-1388

COOPERATING AGENCIES AND INVESTIGATORS: Beak Consultants

DURATION OF EACH PHASE: Contract complete by 1982

APPROXIMATE COST: $70K

OBJECTIVES: To identify sources of drinking water in acid sensitive regions that may contain elevated levels of selected anions or heavy metals.

METHOD: A review of the factors contributing to a water supply's susceptibility to acid was completed. A methodology by which a watershed's potential sensitivity to acid precipitation was developed and applied to individual water supplies across Canada.

ANTICIPATED RESULTS: The report should provide a basis on which to evaluate the sensitivity of a particular water supply.

PROJECT NUMBER: 386

SUBJECT CODE: 3.4

TITLE: The Impact of Lake Acidity on the Quality of Pumped Water Supplied to Cottages in Central Ontario

PRINCIPAL INVESTIGATOR'S NAME: J. C. Meranger

AGENCY AND DEPARTMENT: National Health and Welfare, Bureau of Chemical Hazards

ADDRESS: Tunney's Pasture
Ottawa, Ontario
K1A 0L2

PHONE: (613) 992-1388

COOPERATING AGENCIES AND INVESTIGATORS: Barringer Magenta Ltd.

DURATION OF EACH PHASE: Completed in 1982.

APPROXIMATE COST: $50K

OBJECTIVES: To complete a drinking water survey in areas of Canada receiving acidic deposition and monitor for selected anions.

METHOD: Leaching rates in distribution systems was calculated for various metals. Water samples from private sources were analysed before and after purging of the supply system.

ANTICIPATED RESULTS: Final report showed that care should be exercised when consuming water without pH control in areas of high acidic precipitation.

SUBJECT CODE: 3.5

PROJECT NUMBER: 387

TITLE: Atmospheric Corrosion of Metals

PRINCIPAL INVESTIGATOR'S NAME: J. J. Hechler

AGENCY AND DEPARTMENT: Institut de Génie des Matériaux
Conseil National de Recherche du Canada

ADDRESS: 750, Bel-Air
Montreal, Quebec

PHONE: (514) 935-8513

COOPERATING AGENCIES AND INVESTIGATORS: Canadian Steel Industry Research Association

DURATION OF EACH PHASE: This project was started in summer 1982 and will be an on-going project within the Institute.

APPROXIMATE COST: 82/83 $10,000.

OBJECTIVES: To determine a useful methodology for testing atmospheric corrosion of metals on buildings.

METHOD:

a) Survey 10-15 years old metal-covered buildings and determine the effect of microclimates created by the building structures and their environments.

b) Based on the findings in (a), one or two buildings in the Montreal area will serve as instrumented test sites for various metal samples. SO_2, time-of-wetness and other parameters will be measured at different locations and different heights on the buildings.

c) Extend the testing to buildings in rural and marine locations.

ANTICIPATED RESULTS: Obtain useful data on atmospheric corrosion of metals.

PROJECT NUMBER: 388

SUBJECT CODE: 3.7

TITLE: Angler Behavioural Responses & Economic Assessment of Acid Rain Impacts on the Haliburton/Muskoka Fisheries

PRINCIPAL INVESTIGATOR'S NAME: P. Victor (Victor and Burrell Research and Consulting)

AGENCY AND DEPARTMENT: Economic Research Division/DFO

ADDRESS: 8th Floor West
240 Sparks Street
Ottawa, Ontario
K1A 0E6

PHONE: (613) 995-2091

COOPERATING AGENCIES AND INVESTIGATORS: Scientific Authority - Mr. A.L.W. Tuomi
Fisheries & Oceans
Economic Development Directorate
8th Floor West
240 Sparks Street
Ottawa, Ontario K1A 0E6

DURATION OF EACH PHASE: 01/82 - 10/82

APPROXIMATE COST: 01/82 - 10/82: $47,850

OBJECTIVES:
1. To describe and estimate the likely behavioural responses of sport fishermen, to assess deposition in the Muskoka/Haliburton Region and to estimate the associated economic welfare losses in dollar terms.
2. To evaluate on the basis of a case study, Talhelm's approach to the travel cost method for assessing the effects of acid deposition on sport fishing.

METHOD: Estimates of actual and projected decline in fish productivity in the Muskoka/Haliburton Region, due to acid deposition, will be obtained from a model developed by Hough, Stansbury and Michalski and J.E. Hanna Associates for Fisheries & Oceans. Alternative deposition scenarios will be employed. These methods will provide an essential input for use in the travel cost method developed by D. R. Talhelm. This method provides estimates of the responses of sport fisherman to a decline in catch per unit of effort at various sites, and generates estimates of the associated losses in consumer surplus.

ANTICIPATED RESULTS: An assessment of the suitability of the Talhelm travel cost method to the analysis of the impacts of Acid rain on recreational fisheries in the Muskoka/Haliburton Region.

SECTION 4

INSTRUMENTATION DEVELOPMENT

SUBJECT CODE: 4.0

PROJECT NUMBER: 389

TITLE: Dry Deposition of Acid Forming Emissions in Alberta

PRINCIPAL INVESTIGATOR'S NAME: Mr. R. Angle

AGENCY AND DEPARTMENT: Air Quality Branch, Pollution Control Division
Alberta Environment

ADDRESS: 6th Floor, Oxbridge Place
9820 - 106 Street
Edmonton, Alberta
T5K 2J6

PHONE: (403) 427-5893

COOPERATING AGENCIES AND INVESTIGATORS: Work contracted out to Concord Scientific
2 Tippett Road
Downsview, Ontario
M3H 2V2

DURATION OF EACH PHASE: April 1, 1982 to March 31, 1984

APPROXIMATE COST: $60,000 (82-83)

OBJECTIVES: This is a continuing project to develop and field test the measurement techniques for dry deposition of sulphur dioxide. Subsequent determination of dry deposition velocities in the AOSERP area and in the vicinity of a sour gas plant will be made and related to receptor characteristics and meteorological conditions.

METHOD: Contact principal investigator for methodologies.

ANTICIPATED RESULTS: An initial report will be completed by March 1983 and be available from the Pollution Control Division, Alberta Environment.

PROJECT NUMBER: 390

SUBJECT CODE: 4.0

TITLE: SO_2 Sonde Development

PRINCIPAL INVESTIGATOR'S NAME: Dr. R. Mickle

AGENCY AND DEPARTMENT: Atmospheric Environment Service

ADDRESS: 4905 Dufferin Street
Downsview, Ontario
M3H 5T4

PHONE: (416) 667-4792

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: Ongoing

APPROXIMATE COST: $13.8K 82/83

OBJECTIVES: To develop a differential SO_2 measurement system for tethersonde application.

METHOD: Conventionally, measures of ambient concentrations of atmospheric pollutants are made at surface level. However, for many LRTAP purposes, such as validation of LRTAP models, it is important to know the vertical pollutant structure and in particular to know if the vertical profile information can be inferred from the surface value.

ANTICIPATED RESULTS: A literature search has been completed to determine what other methods might be used to produce SO_2 profiles using tethersonde techniques. Measurement development will provide effective vertical profile measurements during field studies.

SUBJECT CODE: 4.0

PROJECT NUMBER: 391

TITLE: Construction of a Microprocessor Controlled Ion Chromatograph

PRINCIPAL INVESTIGATOR'S NAME: F. Tomassini/M. Rawlings

AGENCY AND DEPARTMENT: Ministry of the Environment, Laboratory Services Branch, Water Quality Section

ADDRESS: P.O. Box 213
Rexdale, Ontario
M9W 5L1

PHONE: (416) 248-3512

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: Duration of Project - 3 years Present Year is - 2nd Year

APPROXIMATE COST:

Total Dollars	
Total Project	Current Year
$10,000	$7,500

OBJECTIVES:

1. To construct initially, a manually operated ion chromatograph from readily available components, having the sensitivity & precision of commercially available units but at a substantial cost saving.
2. To automate the unit to achieve the best possible throughput with the least amount of operator time.

METHOD: The use of ion chromatography as an analytical method has gained wide acceptance in recent years, particularly for the analysis of low ppm levels of SO_4 in precipitation samples and surface waters. Commercially available units are prohibitively expensive to be considered as a routine methodology for a high capacity laboratory. This project will attempt to construct an ion chromatograph from commercially available components. The cost effectiveness of this project will be realized with the construction of more than one system and its success will make ion chromatography accessible to the regional laboratories.

ANTICIPATED RESULTS: The construction of the ion chromatographic unit has been completed with the exception that the injection valve is manually actuated. The A/D converter section of the controller is being held up by parts non-availability.

PROJECT NUMBER: 392

SUBJECT CODE: 4.0

TITLE: Nitric Acid Monitor

PRINCIPAL INVESTIGATOR'S NAME: Dr. K. Anlauf

AGENCY AND DEPARTMENT: Atmospheric Environment Service

ADDRESS: 4905 Dufferin Street
Downsview, Ontario
M3H 5T4

PHONE: (416) 667-4794

COOPERATING AGENCIES AND INVESTIGATORS: OME will fund this unsolicited proposal with $20,000 for 82/83

DURATION OF EACH PHASE: To be completed June 1983.

APPROXIMATE COST: $27.4K 82/83

OBJECTIVES: To develop and test a continuous nitric acid monitor.

METHOD: A lead diode laser, with white cell, will be constructed and calibrated for continuous measurement of low level gaseous nitric acid (0.5 - 5 ppb). The instrument will also provide spot measurements of NO and NO_2 and hence act as an independent method to check on existing methodologies for these gases.

ANTICIPATED RESULTS: A contract awarded in June 1982 will deliver a tested monitor.

SUBJECT CODE: 4.0

PROJECT NUMBER: 393

TITLE: Development of Hydrocarbon and Pan Monitors

PRINCIPAL INVESTIGATOR'S NAME: Dr. J. Bottenheim

AGENCY AND DEPARTMENT: Atmospheric Environment Service

ADDRESS: 4905 Dufferin Street
Downsview, Ontario
M3H 5T4

PHONE: (416) 667-4778

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: Ongoing

APPROXIMATE COST: $38.6K 82/83

OBJECTIVES: To develop in-house capability to collect and analyse ambient air samples for volatile organic components that play a role in ozone and other oxidants formation, including PAN levels in ambient air.

METHOD: The hydrocarbon monitoring technique is based on sampling air in passivated stainless steel cannisters and subsequent analysis by gas chromatography. The methods include C_2 - C_{10} hydrocarbon analysis with emphasis on determination of predominant species in paraffin, olefin and aromatic doses. PAN monitoring technique at the surface are based on on-site sampling and immediate analysis by ECD-gas chromatography. Methods are to be developed to sample air and store for later analysis.

ANTICIPATED RESULTS: Proper evaluation of field observations of hydrocarbons and for sampling PAN at elevated levels.

PROJECT NUMBER: 394

SUBJECT CODE: 4.0

TITLE: Hydroxyl Monitor Development

PRINCIPAL INVESTIGATOR'S NAME: Dr. K. Anlauf

AGENCY AND DEPARTMENT: Atmospheric Environment Service

ADDRESS: 4905 Dufferin Street
Downsview, Ontario
M3H 5T4

PHONE: (416) 667-4794

COOPERATING AGENCIES AND INVESTIGATORS: MONITEQ Corp.
Toronto, Ontario
OME funded $20,000 of this unsolicited proposal (81/82)

DURATION OF EACH PHASE: Completed October 27/82

APPROXIMATE COST: $6.5K

OBJECTIVES: To develop an OH radical monitor.

METHOD: The project which is conducted under contract to Moniteq is designed to construct an OH radical monitor for the measurement of OH concentration in atmospheric samples. OH radical contributes to the predominant gas phase oxidation of SO_2 to sulphate.

ANTICIPATED RESULTS: An effective hydroxyl monitor.
May apply to stratospheric measurements.

SUBJECT CODE: 4.0

PROJECT NUMBER: 395

TITLE: Automated Nephelometer

PRINCIPAL INVESTIGATOR'S NAME: Dr. K. Anlauf

AGENCY AND DEPARTMENT: Atmospheric Environment Service

ADDRESS: 4905 Dufferin Street
Downsview, Ontario
M3H 5T4

PHONE: (416) 667-4794

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: Ongoing

APPROXIMATE COST: $4.9K 82/83

OBJECTIVES: To automate nephelometer calibration.

METHOD: The nephelometer presently used is to be modified so that improved calibration may be effected. This is necessary for measurements where particulate concentrations are low.

ANTICIPATED RESULTS: The automated calibration will allow for continuous measurements of aerosols at any APN site, and may facilitate correlations with sulphate particulate concentrations. If correlation is very high, then the nephelometer will yield diurnal variation in particulate sulphate concentrations.

PROJECT NUMBER: 396

SUBJECT CODE: 4.0

TITLE: Ozone Sonde Development

PRINCIPAL INVESTIGATOR'S NAME: Dr. R. Mickle, E. I. Mukammal

AGENCY AND DEPARTMENT: Atmospheric Environment Service

ADDRESS: 4905 Dufferin Street
Downsview, Ontario
M3H 5T4

PHONE: (416) 667-4792
-4641

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: Ongoing

APPROXIMATE COST: $25.0K 82/83

OBJECTIVES: To develop a reliable low-level measurement system.

METHOD: Developmental work to continue while field measurements are made at current study sites (used at Nanticoke in June and August '82). Ozone Sondes are used in conjunction with Tethersondes (minisondes).

ANTICIPATED RESULTS: A reliable ozone sonde measuring system for tropospheric conditions to provide information on vertical profile of ozone in the boundary layer (up to 300 metres).

SUBJECT CODE: 4.0

PROJECT NUMBER: 397

TITLE: Ozone Calibration System

PRINCIPAL INVESTIGATOR'S NAME: Dr. K. Anlauf

AGENCY AND DEPARTMENT: Atmospheric Environment Service

ADDRESS: 4905 Dufferin Street
Downsview, Ontario
M3H 5T4

PHONE: (416) 667-4794

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: Completion by March 1983.

APPROXIMATE COST: $23.0K

OBJECTIVES: To develop an in-house ozone calibration system.

METHOD: Development to produce an ozone calibration system is based on the ultra-violet absorption method.

Assembly and testing of hardware purchased for this development will be completed by March 1983.

ANTICIPATED RESULTS: To have an in-house capability to calibrate its ozone analyzers and ozone sondes used in field measurements.

PROJECT NUMBER: 398

SUBJECT CODE: 4.0

TITLE: Controller for an Automated Ion Chromatograph System

PRINCIPAL INVESTIGATOR'S NAME: M. W. Rawlings

AGENCY AND DEPARTMENT: Ministry of the Environment, Laboratory Service Branch, Water Quality Section

ADDRESS: P.O. Box 213
Rexdale, Ontario
M9W 5L1

PHONE: (416) 248-3512

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: Duration of Project - 2 years Present Year is - 2nd year

APPROXIMATE COST:

	Total Dollars	
	Total Project	Current Year
	$3,500	$3,500

OBJECTIVES: To design and implement a controller for the ion chromatograph which will: time and control sample injection and multi-place sampler, initiate a regeneration cycle at the end of a run, release the peristaltic pump, turn off the chart recorder.

METHOD: The key to efficient ion chromatography for the Precipitation Lab is "automated runs", long enough to use the full capacity of the columns. Since this involves after-hours running, a system capable of regenerating the columns and shutting down the equipment is required.

A PET microcomputer will be used to generate the timing and control signals. The control signals will be transmitted via solid state relays. The circuitry will be our design. The chromatographic column valves will be controlled by electrically operated 3-way solenoid valves.

ANTICIPATED RESULTS: Practical work has been completed; the controller is in routine use in the Rivers and Lakes Lab, and is working well.

SUBJECT CODE: 4.0

PROJECT NUMBER: 399

TITLE: Acid Precipitation Estimation by Indicating Ion Exchange

PRINCIPAL INVESTIGATOR'S NAME: Robert A. Stairs

AGENCY AND DEPARTMENT: Department of Chemistry

ADDRESS: Trent University
Peterborough, Ontario
K9J 7B8

PHONE: (705) 748-1506

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: Development of method - 1 year
Refinement and redesign - 2 years

APPROXIMATE COST: $10,000 pa.

OBJECTIVES: To develop a method of estimating acid precipitation that will:

(1) measure acidity of the rain as it falls, avoiding problems of reaction during sample storage,
(2) yield an integrated measure over a period (week, month) as well as single events;
(3) be cheaper than present methods.

METHOD:

(1) Rain gauge is modified to allow rain to percolate through a bed of weakly-basic ion exchange resin stained with acid-base indicator. Length of new band of altered colour is measure of total amount of strong acid fallen per unit area since the last reading.

(2) Electronically measure the conductance of two samples of rain. Sample 1 is untreated, sample 2 is treated by passage through acid ion-exchange resin. Yields concentration of strong acids and salts of strong acids. Data read out on demand.

ANTICIPATED RESULTS: Method 1 is ideally inexpensive ($\simeq$ $10 per apparatus) but so far not sensitive enough. Method 2 will cost more, but will yield both event and integrated data. Prototype is in construction phase. Testing this winter and spring. Redesign for small scale production will follow. Though more expensive than Method 1, it will be less expensive than a technician with a pH meter.

PROJECT NUMBER: 400

SUBJECT CODE: 4.0

TITLE: Automated Data Acquisition for the Ion Chromatograph

PRINCIPAL INVESTIGATOR'S NAME: M. W. Rawlings

AGENCY AND DEPARTMENT: Ministry of the Environment, Laboratory Services Branch, Water Quality Section

ADDRESS: P.O. Box 213
Rexdale, Ontario
M9W 5L1

PHONE: (416) 248-3512

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: Duration of Project - 1 year

APPROXIMATE COST: $6,000.

OBJECTIVES: To design and implement an analog/digital converter to be added to the automated ion chromatograph controller such that peaks may be read by the controlling computer.

METHOD: An interface permitting microcomputer control of the ion chromatograph has been built and tested, and is in routine use. The addition of automated acquisition of peaks and reduction to analytical values by acquired calibrations will fully automate the equipment. An A/D converter will be constructed following the guidance of the Data Conversion/Acquisition Handbook published by National Semiconductor Corporation. A microcomputer program to process the acquired data will be developed.

ANTICIPATED RESULTS: The A/D converter construction is being held up by parts non-availability. An alternative converter may be considered. Software cannot proceed until the converter is obtained as the converter protocols will dictate the exact form of the software.

SECTION 5

ANALYTICAL METHODOLOGY

SUBJECT CODE: 5.1

PROJECT NUMBER: 401

TITLE: Optimization of Instrumental Neutron Activation Analysis of Airborne Particulate Material

PRINCIPAL INVESTIGATOR'S NAME: D. D. Burgess

AGENCY AND DEPARTMENT: McMaster University, Department of Chemistry

ADDRESS: Nuclear Research Building
McMaster University
1280 Main Street West
Hamilton, Ontario
L8S 4K1

PHONE:

COOPERATING AGENCIES AND INVESTIGATORS: Ontario Ministry of the Environment
Air Resources Branch

DURATION OF EACH PHASE: Continuing

APPROXIMATE COST: $15K (1982-1983)

OBJECTIVES: Development of methods for obtaining optimal procedures for multielement analysis of airborne solids by instrumental neutron activation analysis.

METHOD: The technique of advance prediction of the gamma-ray spectrum obtained after neutron activation of a sample of airborne solids will be used to evaluate proposed values of the principal experimental conditions. This procedure will be linked with a simplex optimization calculation to arrive at optimal conditions for instrumental neutron activation analysis of airborne particulates.

ANTICIPATED RESULTS: The development and application of improved methods of analysis of airborne particulate material will provide improved understanding of the formation, behaviour, sources and hazards of airborne solids.

PROJECT NUMBER: 402

SUBJECT CODE: 5.1

TITLE: Chemical Speciation of Airborne Particulate Matter

PRINCIPAL INVESTIGATOR'S NAME: D. D. Burgess

AGENCY AND DEPARTMENT: McMaster University, Department of Chemistry

ADDRESS: Nuclear Research Building
McMaster University
1280 Main Street West
Hamilton, Ontario
L8S 4K1

PHONE:

COOPERATING AGENCIES AND INVESTIGATORS: Ontario Ministry of the Environment
Air Resources Branch

DURATION OF EACH PHASE: Continuing

APPROXIMATE COST: $15K (1982-1983)

OBJECTIVES: Development of methods for the determination of the chemical form of elements present in airborne particulate matter and subsequent characterisation of urban, rural and remote aerosols.

METHOD: Elements will be removed from their compounds by volatilization with a gaseous reagent (reactive gas extraction) for collection and determination by neutron activation analysis. Conditions and reagents will be sought which will permit selective attack upon individual compounds or groups of compounds.

ANTICIPATED RESULTS: The development and application of methods for chemical speciation of airborne particulate material will provide improved understanding of the formation, behaviour, sources and hazards of airborne solids.

SUBJECT CODE: 5.1

PROJECT NUMBER: 403

TITLE: Trace Analysis for Aluminum: Method Development and Application to Natural Waters

PRINCIPAL INVESTIGATOR'S NAME: Keith E. Johnson

AGENCY AND DEPARTMENT: Chemistry

ADDRESS: University of Regina
Regina, Saskatchewan
S4S 0A2

PHONE: (306) 584-4012

COOPERATING AGENCIES AND INVESTIGATORS: CCIW, Burlington, Ontario
Mr. F. Elder

DURATION OF EACH PHASE: 04/82 - 04/84

APPROXIMATE COST: 04/82 - 04/83: $10K

OBJECTIVES:

1. To ascertain the possible methods for trace analysis of aluminum in water, to test those in current use and to attempt a comparison of the various suggested assignments of values to "organic", "polymeric inorganic", and monomeric inorganic "free ionic" aluminum.
2. To develop a consistent procedure for determining free and total aluminum in water.
3. To apply the developed procedure to natural and synthetic, clean and polluted waters and to study the effects of acidification on available aluminum levels.

METHOD:

1. To establish the sensitivity of IC plasma spectroscopy, AA spectroscopy, d.c. polarography and pulse polarography for aluminum detection in water.
2. To test the efficacy of MIBK extraction of aluminum oxine as a route to separating monomeric aluminum.
3. To test the effect of complexing on aluminum ion exchange.

ANTICIPATED RESULTS: A clear relationship between analytical method and aluminum species.

PROJECT NUMBER: 404

SUBJECT CODE: 5.1

TITLE: Development of a bioassay technique for detection of exposure to environmental toxins

PRINCIPAL INVESTIGATOR'S NAME: B. R. Hollebone

AGENCY AND DEPARTMENT: Carleton University, Chemistry Dept.

ADDRESS: Col. By Drive
Ottawa, Ontario
K1S 5B6

PHONE: (613) 231-5627

COOPERATING AGENCIES AND INVESTIGATORS: Canadian Wildlife Service
D. B. Peakal

DURATION OF EACH PHASE: 04/81 - 04/82

APPROXIMATE COST: $35K (1981 - 1982)

OBJECTIVES: Development of a practical hierachial hepatic multifunction oxidase assay for detection of environmental exposure of wild populations to toxic organic chemicals and heavy metals.

METHOD: Derivation of dose and time - response curves for MFO response to polyaromatic hydrocarbons and lead in feeding studies on rats and doves with field tests on herring gulls.

ANTICIPATED RESULTS: Development of bioassay techniques for exposure to pollutants for devising zoogeographic plots of environmental toxins.

SUBJECT CODE: 5.1

PROJECT NUMBER: 405

TITLE: Acidity Component Fractionation

PRINCIPAL INVESTIGATOR'S NAME: F. Tomassini/W. Wright

AGENCY AND DEPARTMENT: Ministry of the Environment, Laboratory Services Branch, Water Quality Section

ADDRESS: P.O. Box 213
Rexdale, Ontario
M9W 5L1

PHONE: (416) 248-3512

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: Duration of Project - 3 years Present Year is - 2nd year

APPROXIMATE COST:

Total Dollars	
Total Project	Current Year
$10,000	$5,000

OBJECTIVES: To establish a standard methodology for determining the major acidic components in precipitation samples collected under the APIOS program.

METHOD: The following studies will be undertaken with the anticipated result of providing a standard methodology which provides as much information as possible regarding the acidity of precipitation samples:

(a) development of an adequate quality control program for acidity,

(b) determining the effect of various methodologies on the carbonic acid component in precipitation samples,

(c) an attempt to differentiate between strong and weak acid contributions to the acidity in precipitation samples.

ANTICIPATED RESULTS: A report will be available on parts (a) and (b) by October 1982. Part (c) is still under investigation with no date set for a report.

PROJECT NUMBER: 406

SUBJECT CODE: 5.1

TITLE: Determination of Bromide by Ion Chromatography

PRINCIPAL INVESTIGATOR'S NAME: W. Wright

AGENCY AND DEPARTMENT: Ministry of the Environment, Laboratory Services Branch, Water Quality Section

ADDRESS: P.O. Box 213
Rexdale, Ontario
M9W 5L1

PHONE: (416) 248-3512

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE:

APPROXIMATE COST:

OBJECTIVES: To determine bromide at ppb levels in precipitation samples.

METHOD: Bromide is normally present in automobile exhausts and should serve as a tracer for this type of manmade pollution. Bromide will be determined in aqueous samples by ion chromatography after having pretreated the samples to reduce interferences such as nitrate which may also be present.

ANTICIPATED RESULTS: This project has been turned over to another investigator due to retirement and a new literature search has been initiated.

SUBJECT CODE: 5.1

PROJECT NUMBER: 407

TITLE: Low Level Fluoride Measurement by Ion Specific Electrode

PRINCIPAL INVESTIGATOR'S NAME: S. Barnes

AGENCY AND DEPARTMENT: Ministry of the Environment, Laboratory Services Branch, Water Quality Section

ADDRESS: P.O. Box 213
Rexdale, Ontario
M9W 5L1

PHONE: (416) 248-3512

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: Duration of Project - 6 months

APPROXIMATE COST: $2,600

OBJECTIVES: To develop a method for the measurement of fluoride in the microgram per litre range, in low ionic strength samples.

METHOD: A Technicon Ion specific Electrode Module in conjunction with a compatible fluoride electrode system is employed in an automated system to measure total fluoride in the 0 - 50 ug/L range. No sample preparation is necessary and only a single reagent (total Ionic strength adjustment buffer) is required for the analysis.

ANTICIPATED RESULTS: The method is being developed in order that a speciation model for aluminum in waters subject to acidic precipitation can be developed. The method is now being applied successfully to these samples.

PROJECT NUMBER: 408

SUBJECT CODE: 5.2

TITLE: Interlab Comparisons of N.S. Lake Chemistry

PRINCIPAL INVESTIGATOR'S NAME: Mr. John K. Underwood

AGENCY AND DEPARTMENT: Nova Scotia Department of the Environment

ADDRESS: P.O. Box 2107
Halifax, Nova Scotia
B3J 3B7

PHONE: (902) 424-5300

COOPERATING AGENCIES AND INVESTIGATORS:
H. Vaughan, Nova Scotia Department of the Environment
R. McCurdy, Environmental Chemistry, N.S. Health
T. Pollock, IWD, Moncton; Senes Consultants, Willowdale, Ontario

DURATION OF EACH PHASE: Ongoing

APPROXIMATE COST: As appropriate.

OBJECTIVES: Because of the dilute nature of N.S. waters as well as known and potential analytical interference by organic acids NSDOE takes advantage of every opportunity to compare precision and accuracy of results from different labs.

METHOD:
- Submission of replicate water samples to different labs.
- Analysis of the results, discussion of analytical techniques.
- When specific problems are found (e.g. $SO_4^=$, TOC) initiation of an appropriate investigation.
- To date we have been involved in the investigation and resolution of sensitive SO_4 techniques given the unsuitable nature of the MTB method in dystrophic water. Confidence in other chemical parameters has also been ensured.
- Problems with TOC and colour measurements are presently under consideration.

ANTICIPATED RESULTS: Maintenance of accurate analyses on which to base interpretation of chemical changes in N.S. lakes. One series of interlab comparisons is in Gordon, Keizer, Ogden, Underwood & Wiltshire, 1981. Synoptic water quality study of fifty lakes in the Halifax, N.S. Metro area on 14 April 1980 - available through NSDOE.

SUBJECT CODE: 5.2

PROJECT NUMBER: 409

TITLE: LRTAP Quality Assurance

PRINCIPAL INVESTIGATOR'S NAME: K. I. Aspila

AGENCY AND DEPARTMENT: Environment Canada

ADDRESS: National Water Research Institute
Analytical Methods Division
P.O. Box 5050
Burlington, Ontario
L7R 4A6

PHONE: (416) 637-4638

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE:

APPROXIMATE COST: $43K

OBJECTIVES: To design, verify and deliver four interlaboratory studies on aqueous substrates and then evaluate, document and report on the comparability of the laboratory measurement process in those labs that support the LRTAP. This project will support the LRTAP quality assurance subgroup.

METHOD: For each study, consisting of 10 to 15 test samples (natural and synthetic) and addressing 5 to 15 parameters, lab results will be ranked using the method of Youden. Lab results deviating significantly from medians will be flagged. Bias in lab measurements will be defined from average lab ranks for each parameter. Lab specific reports will be prepared and divant labs informed about measurement bias or erratic control of method applications.

ANTICIPATED RESULTS: Four interlab studies.

SECTION 6

INTERIM MITIGATION MEASURES

CODE DU SUJET: 6.1

NUMÉRO DE PROJET: 410

TITRE: Paléolimnologie récente de deux lacs chaulés en 1945

NOM DU CHERCHEUR RESPONSABLE: Marcel Ouellet

MINISTÈRE, ORGANISME OU ORGANISME PRIVÉ, SERVICE: INRS-Eau, Université du Québec

ADRESSE: C.P. 7500
Sainte-Foy, Québec
G1V 4C7

TÉLÉPHONE: (418) 657-2555

COLLABORATEUR(S), ORGANISME(S) ET CHERCHEUR(S): H.G. Jones
INRS-Eau
Université du Québec
C.P. 7500
Sainte-Foy, Québec
G1V 4C7

DURÉE DE CHAQUE PHASE:
a) échantillonnage : juin 1982
b) analyse : hiver 1982
c) compilation et rédaction: printemps 1983

COÛT APPROXIMATIF: Juin 1982 à mars 1983: $5,000

OBJECTIFS DE TRAVAIL: Prédire les répercussions des futurs chaulages de lacs en fonction du comportement paléolimnologique des lacs chaulés et fertilisés en 1945.

MÉTHODE DE TRAVAIL:
a) échantillonnage stratigraphique des deux lacs chaulés en 1945;
b) analyse géochimique,
c) compilation et rédaction.

RÉSULTATS PRÉVUS:
a) déplacement stratigraphique de la flore des Diatomées en 1945-56;
b) maximum stratigraphique du Ca, K, Na et du MS en 1945-56
c) maximum stratigraphique de certains métaux lourds dans l'intervalle stratigraphique de 1945-46.

PROJECT NUMBER: 411

SUBJECT CODE: 6.1

TITLE: Reclamation of Acidified Fish Habitat by Lake and River Liming

PRINCIPAL INVESTIGATOR'S NAME: W. D. Watt
W. J. White

AGENCY AND DEPARTMENT: Department of Fisheries & Oceans

ADDRESS: Resource Branch
Freshwater & Anadromous Division
Halifax, Nova Scotia

PHONE: (902) 426-3606

COOPERATING AGENCIES AND INVESTIGATORS: W. J. White and outside contract

DURATION OF EACH PHASE: Baseline surveys: 2 years
Post liming assessment: 4 years

APPROXIMATE COST: Baseline (1981-83) $10,000/year
Liming and assessment: (1983-87) $100,000/year
O & M; and $50,000 Capital in first year,
$10,000/year thereafter.

OBJECTIVES: Demonstrate practicality of restoring a significant portion of an acidified river to Atlantic salmon production.

METHOD: Liming etc. - methods to be decided on when results from 1981-82 precurser studies on Mitigation techniques, aluminum toxicity and aquatic insect survival are available.

ANTICIPATED RESULTS: Create a refuge adequate to sustain a nucleus of the native stock through the interim while awaiting effective emission controls.

SUBJECT CODE: 6.1

PROJECT NUMBER: 412

TITLE: Physico-Chemical Lake and River Responses to Lime Additions

PRINCIPAL INVESTIGATOR'S NAME: W. D. Watt

AGENCY AND DEPARTMENT: Department of Fisheries & Oceans, Fisheries Research Branch

ADDRESS: P.O. Box 550
Halifax, Nova Scotia
B3J 2S7

PHONE: (902) 426-3606

COOPERATING AGENCIES AND INVESTIGATORS: G. J. Farmer
W. J. White
Outside contractors

DURATION OF EACH PHASE: 4 years (1980-84)

APPROXIMATE COST: $50,000/year O & M + $10,000/year Capital

OBJECTIVES: Establish lime dosages required to achieve satisfactory pH control, and to investigate different conditions and techniques of lime application.

METHOD: Experimental use of calcite and dolomite gravel in streams followed by monitoring of pH under varying flow and temperature regimes. Under different regimes of temperature, mean residence time and acidity, limestone as a slurry was sprayed from a boat, aircraft and hovercraft or pumped via diffusers on ice or along shorelines. Slaked lime was also used.

ANTICIPATED RESULTS: To establish tentative costs and dosage requirements relative to flow, temperature and acidity for gravel application in streams, and relative to volume, mean residence time, acidity and temperature for lake treatments.

PROJECT NUMBER: 413

SUBJECT CODE: 6.1

TITLE: Monitoring of Effects of Experimental Neutralization of Acid Lakes on Aquatic Insects

PRINCIPAL INVESTIGATOR'S NAME: W. J. White

AGENCY AND DEPARTMENT: Department of Fisheries & Oceans

ADDRESS: Resource Branch
Freshwater & Anadromous Division
Halifax, Nova Scotia

PHONE: (902) 426-3576

COOPERATING AGENCIES AND INVESTIGATORS: W. D. Watt

DURATION OF EACH PHASE: Pre-liming control study - July 1980 to July 1981
Post-liming study - August 1981 to July 1984

APPROXIMATE COST: $15,000 O & M and $5,000 Capital for 1981-84.

OBJECTIVES: To determine whether sudden rises in pH from values of less than 4.5 approximately to neutrality will produce severe declines in insect populations of streams similar to those observed in zooplankton faunas of some experimentally neutralized lakes in Ontario.

METHOD: Artificial substrates consisting of standardized baskets of sorted gravel were installed in groups at five sites in a stream downstream from an experimentally neutralized lake and at the same number of sites upstream from the lake. Some samplers will be removed at pre-determined periods and invertebrates found in them identified and counted. The experiment will be repeated several times before lake liming and several times after. Surber samplers and underwater light traps will also be employed.

ANTICIPATED RESULTS:

(1) a technical report and possibly a publishable paper will be prepared.

(2) the results will be used to determine the timing of re-stocking with fish after neutralization of lakes or rivers.

SUBJECT CODE: 6.1

PROJECT NUMBER: 414

TITLE: Restoration of Atlantic Salmon by Hatchery Stocking in 3 Acidic Rivers

PRINCIPAL INVESTIGATOR'S NAME: Dr. G. J. Farmer

AGENCY AND DEPARTMENT: Department of Fisheries & Oceans, Fisheries Research Branch

ADDRESS: P.O. Box 550
Halifax, Nova Scotia
B3J 2S7

PHONE: (902) 426-7819

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: Operation: April 1981 to March 1984.

APPROXIMATE COST: Total Cost for 3 year period: $60K ($20,000/year)

OBJECTIVES:

a) Examine the feasibility of mitigating stream acidity by the use of limestone gravel;

b) Introduce juvenile Atlantic salmon to acidic streams which have received limestone gravel;

c) Conduct water quality survey on major tributaries to 15 Nova Scotia salmon rivers.

METHOD:

a) Three acidic streams (pH $<$ 5.0) have received applications of limestone gravel (50-110 metric tonnes). Water chemistry parameters, flow and invertebrate populations are being monitored above and below the limestone sites.

b) Smolts and fall fingerling salmon have been released at two sites. Electro-fishing surveys will be used to assess spawning success and juvenile survival.

c) Water chemistry surveys on major tributaries to 15 Nova Scotia salmon rivers threatened by acid precipitation have been completed.

ANTICIPATED RESULTS:

a) A predictive equation has been developed relating increase in stream pH to water flow, water temperature and the weight of limestone gravel.

b) A report is being prepared listing the water quality of the major tributaries to 15 Nova Scotia salmon rivers.

c) Spawning success and survival of juvenile salmon will provide a measure of the effectiveness of mitigating stream acidity by the use of limestone gravel.

PROJECT NUMBER: 415

SUBJECT CODE: 6.1

TITLE: Study of the Use of Limestone Gravel as a Spawning Medium for Atlantic Salmon in the Liscomb River

PRINCIPAL INVESTIGATOR'S NAME: R. W. Gray and J. R. Semple

AGENCY AND DEPARTMENT: Department of Fisheries & Oceans, Fisheries Research Branch

ADDRESS: P.O. Box 550
Halifax, Nova Scotia
B3J 2S7

PHONE: (902) 426-2599

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE:
(a) Set up: October 6-20, 1980
(b) Second phase set up: July-August, 1981
(c) Operation: October 1980 - October 1983

APPROXIMATE COST: $6,000 O & M in 1982-83.

OBJECTIVES:
(a) To improve Atlantic salmon spawning habitat.

(b) To increase pH by one unit to 5.7 and improve fry survival.

(c) Applicable methods will be used to increase river pH in some salmon rivers in Nova Scotia's Atlantic seaboard.

METHOD:
(a) Limestone spawning gravel (5 cm to 10 cm diameter) was added to 3 sections of the stream simulating gradients, velocities, and depths found in typical spawning habitats.

(b) Water quality will be monitored monthly, analyses to be carried out by Inland Waters Directorate, Moncton.

(c) Areas will be sampled for spawning redds and juvenile production compared to untreated segments of the stream.

ANTICIPATED RESULTS:
(a) Data will be published in DFO report series and made available to public through Atlantic Salmon Advisory Committees for possible use in public participation component of the Atlantic Salmon Enhancement Program.

(b) Results of the study will be reviewed relative to other initiatives/techniques to increase pH in salmon producing waters of the province of Nova Scotia.

SUBJECT CODE: 6.1

PROJECT NUMBER: 416

TITLE: Aluminum Toxicity in Nova Scotia

PRINCIPAL INVESTIGATOR'S NAME: W. D. Watt

AGENCY AND DEPARTMENT: Department of Fisheries & Oceans

ADDRESS: Resource Branch
Freshwater & Anadromous Division
Halifax, Nova Scotia

PHONE: (902) 426-3606

COOPERATING AGENCIES AND INVESTIGATORS: Various contractors

DURATION OF EACH PHASE: Two years

APPROXIMATE COST: $20,000/1983-84.

OBJECTIVES: To ascertain if aluminum concentrations presently at levels of 200-300 ppb will be toxic to fish and invertebrates after the pH is raised by liming.

METHOD: Flow-through bioassays using natural river waters with pH adjusted up by lime treatment.

ANTICIPATED RESULTS: Establish tolerance levels for aluminum in acidified rivers to be reclaimed by liming and/or other mitigation techniques.

PROJECT NUMBER: 417

SUBJECT CODE: 6.1

TITLE: Effect of Large Lake Neutralization on Amphibian Presence, Reproduction, Littoral Zone Habitat

PRINCIPAL INVESTIGATOR'S NAME: V. Glooschenko

AGENCY AND DEPARTMENT: Ministry of Natural Resources, Wildlife Branch

ADDRESS: Whitney Block, Queen's Park
Toronto, Ontario
M7A 1W3

PHONE: (416) 965-7641

COOPERATING AGENCIES AND INVESTIGATORS:

Mr. Wayne Weller
Proctor & Redfern
75 Eglinton Ave. E.
Toronto, Ontario
M4P 1H3

Dr. D. P. Dodge
Fisheries Br.
M.N.R.
Whitney Block
Queen's Park
Toronto, Ont.
M7A 1W3

Dr. T. Brydges
Min. of Environ.
Resources Road
Rexdale, Ontario

DURATION OF EACH PHASE: Field Work: June, July, 1982
Analyses and report: January, 1983

APPROXIMATE COST: $6.0K

OBJECTIVES: Assessment of habitat, distribution of amphibians around candidate lakes for provincial lake neutralization program.

Post lake neutralization assessment to follow.

METHOD:

- description of habitat including littoral zone and emergent vegetation,
- water chemistry (physical and chemical parameters),
- amphibian distribution and reproductive success.

ANTICIPATED RESULTS: Determination of effect, neutralization of an acidic lake ecosystem on amphibian presence, reproduction.

Observation of change, adaptation in littoral zone emergent and submergent vegetation.

CODE DU SUJET: 6.1

NUMÉRO DE PROJET: 418

TITRE: Encadrement et évaluation des interventions expérimentales pour contrer l'acidification du milieu aquatique

NOM DU CHERCHEUR RESPONSABLE: Lévis Talbot

MINISTÈRE, ORGANISME OU ORGANISME PRIVÉ, SERVICE: Service de la qualité des eaux
Ministère de l'Environnement du Québec (MENVIQ)

ADRESSE: 2360, chemin Ste-Foy
Ste-Foy, Québec
G1V 4H2

TÉLÉPHONE: (418) 643-4425

COLLABORATEUR(S), ORGANISME(S) ET CHERCHEUR(S): Ministère du Loisir, de la Chasse et de la Pêche (MLCP)
Ministère de l'Agriculture, des Pêches et de l'Alimentation (MAPA)
Laboratoires de Québec, MENVIQ
Divers intervenants

DURÉE DE CHAQUE PHASE:

COÛT APPROXIMATIF:

Activité 1 - juillet 1982: $2,000 (MENVIQ, MLCP & MAPA)
Activité 2 - selon la demande: $2,000 " " "
Activité 3 - environ six mois avant et un an (Intervenant) après intervention
Activité 4 - tel que requis en 3: $200 par intervention
Activité 5 - l'été avant et l'été après (Intervenant) intervention
Activité 6 - annuellement à partir de 1983: $3,000 (MENVIQ, MLCP et MAPA)

OBJECTIFS DE TRAVAIL:

Évaluer l'efficacité et les effets secondaires des interventions directes sur le milieu.
Acquérir une expertise technique et scientifique sur différents modes d'interventions directes sur le milieu.
Mettre à la disposition d'intervenants éventuels l'expertise acquise.

MÉTHODE DE TRAVAIL:

Activité 1 - Production d'un guide technique et scientifique sur les modes d'interventions directes sur le milieu.
Activité 2 - Fournir, aux intervenants éventuels, l'expertise technique et scientifique sur les modes d'interventions directes sur le milieu.
Activité 3 - Échantillonnage, par les intervenants, de l'eau avant et après intervention, le tout tel que défini dans le guide.
Activité 4 - Fournir, aux intervenants, le support de laboratoire pour effectuer les analyses physico-chimiques de l'eau avant et après intervention.
Activité 5 - Échantillonnage, par les intervenants, d'un certain nombre de paramètres biologiques, tel que défini dans le guide.
Activité 6 - Synthèse annuelle des résultats obtenus et révision du guide.

SECTION 7

DATA STORAGE

SUBJECT CODE: 7.0

PROJECT NUMBER: 419

TITLE: NAQUADAT DATA BASE

PRINCIPAL INVESTIGATOR'S NAME: Dr. S. H. Whitlow

AGENCY AND DEPARTMENT: Department of Environment, ECS

ADDRESS: Inland Waters Directorate
Water Quality Branch, 10th Floor
Place Vincent Massey
Ottawa, Ontario
K1A 0E7

PHONE: (613) 997-3422

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: Ongoing

APPROXIMATE COST: 0.8 PY, $20K O&M (FY 83-84)

OBJECTIVES: To update and maintain a satisfactory water quality data base management in support of the LRTAP Monitor Program.

METHOD: Data from the LRTAP water quality monitoring sites, and other water quality data useful to the LRTAP program will be added to the NAQUADAT Data Base. This data will be inventoried and made available as requested.

ANTICIPATED RESULTS: A bank of good quality water data will be available for assessing the trends, related to a future emission control agreement.

PROJECT NUMBER: 420

SUBJECT CODE: 7.0

TITLE: Storage of Lake Chemistry, Zooplankton, and Watershed Characteristics of the Greater Sudbury Area in Digital Form

PRINCIPAL INVESTIGATOR'S NAME: J. Roger Pitblado

AGENCY AND DEPARTMENT: Department of Geography

ADDRESS: Laurentian University
Sudbury, Ontario
P3E 2C6

PHONE: (705) 675-1151
Ext. 666 or 384

COOPERATING AGENCIES AND INVESTIGATORS: Contract work for the Sudbury Office, Ontario Ministry of the Environment (Contact: W. Keller).

DURATION OF EACH PHASE: 01/79 - 03/83

APPROXIMATE COST: 01/79 - 03/83 Est. $5,000

OBJECTIVES: Create computer data files for the Sudbury Office of the Ontario Ministry of the Environment for:

1. Lake chemistry - extensive monitoring of lakes in the greater Sudbury area; 209 lakes, 1974-76 data.
2. Zooplankton data, 187 lakes; 1974-76 data.
3. Lake chemistry data; 250 lakes, 1981 data.
4. Zooplankton data; 249 lakes, 1981 data.
5. Lake chemistry data; 250 lakes; 1982 data.
6. Watershed characteristics: 196 lakes/watersheds.

METHOD: Data stored in digital form using DEC 2020 discs and tapes.

ANTICIPATED RESULTS: Items 1 to 4 and 6 completed, Item 5 to be completed by 03/83.

SUBJECT CODE: 7.0

PROJECT NUMBER: 421

TITLE: Sulphur Dioxide Emission/Inventory

PRINCIPAL INVESTIGATOR'S NAME: B. B. Manna

AGENCY AND DEPARTMENT: Ministry of Environment/Air Studies Branch

ADDRESS: Air Studies Branch
Ministry of Environment
Parliament Buildings
Victoria, British Columbia
V8V 1X5

PHONE: (604) 387-1834

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: April 1982 to April 1983

APPROXIMATE COST: 04/82 - 04/83 $3,000

OBJECTIVES: A detailed breakdown of SO_2 emissions by source category (smelting, natural gas processing, forest product industries).

METHOD: Emission inventory from permit data and stack sampling results.

ANTICIPATED RESULTS: Sulphur dioxide emission inventory of British Columbia will be computerized by spring 1983.

SECTION 8

OTHER STUDIES

SUBJECT CODE: 8.0

PROJECT NUMBER: 422

TITLE: Coordination of Canadian Wildlife Service, LRTAP Effects Program; Scientific Advice and Committee Support for DOE - LRTAP Program

PRINCIPAL INVESTIGATOR'S NAME: K. L. Fischer

AGENCY AND DEPARTMENT: Canadian Wildlife Service, Environment Canada
National Wildlife Research Centre

ADDRESS: 100 Gamelin Boulevard
Hull, Quebec
K1A 0E7

PHONE: (819) 997-1410

COOPERATING AGENCIES AND INVESTIGATORS:

- IWD, Lands, CFS
- DOE Departmental and Interdepartmental Committees
- Federal - Provincial RMCC - LRTAP Subgroups
- other Scientific Committees similar to the MOI Working Groups.

DURATION OF EACH PHASE:

APPROXIMATE COST: $5K per year.

OBJECTIVES: To develop and coordinate the wildlife effects research of the DOE - LRTAP program. To participate in scientific committees and contribute to the understanding of LRTAP effects by federal - provincial subgroups.

METHOD:

ANTICIPATED RESULTS:

PROJECT NUMBER: 423

SUBJECT CODE: 8.0

TITLE: Coordination of the Inland Waters Directorate LRTAP Program

PRINCIPAL INVESTIGATOR'S NAME: F. C. Elder

AGENCY AND DEPARTMENT: Dept. of Environment, National Water Research Institute

ADDRESS: Canada Centre for Inland Waters
P.O. Box 5050
Burlington, Ontario
L7R 4A6

PHONE: (416) 637-4212

COOPERATING AGENCIES AND INVESTIGATORS:
Environmental Conservation Service
Lands Directorate and Canadian Wildlife Service
Canadian Forestry Service
Atmospheric Environment Service

DURATION OF EACH PHASE: Annual and Long Range Plan Development

APPROXIMATE COST: $5K (FY 82-83)

OBJECTIVES: To coordinate the IWD LRTAP program under the framework of the DOE and ECS programs and to develop the IWD LRTAP program plans.

The IWD LRTAP program includes the primary research related to the geochemical impact of LRTAP within the DOE program.

METHOD: LRTAP program plans are developed on an annual basis under the guidelines of the long-term DOE and ECS plans. Planning for the program resources and monitoring of program achievements are included.

Program information is developed through research reports and provided to the LRTAP program through workgroup contributions and published reports.

ANTICIPATED RESULTS: Program plans are developed on an annual basis according to the IWD schedule. Final plans are completed by about March. Long term plans are updated annually.

Progress and technical reports are prepared as work is completed but on a minimum 6 month interval.

SUBJECT CODE: 8.0

PROJECT NUMBER: 424

TITLE: Arsenic and Selenium in Northern Ontario Lakes

PRINCIPAL INVESTIGATOR'S NAME: H.K.T. Wong/J. O. Nriagu

AGENCY AND DEPARTMENT: Aquatic Ecology Division, National Water Research Institute

ADDRESS: 867 Lakeshore Road
Burlington, Ontario
L7R 4A6

PHONE: (416) 637-4547
637-4252

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: Continuing, April 1983 to March 1984.

APPROXIMATE COST: $0.5K Capital $9K O & M

OBJECTIVES: Results from our work in the Sudbury area point to extensive contamination of the lakes with reference to As and Se. Most of such pollutants presumably come from the smelters, and the possibility therefore exists for using the distribution of the two pollutant elements as a tracer for long-range transport of aerosols from the super-stacks.

METHOD:

- field sampling once a month May to October 1983 utilizing sediment traps, this is done in conjuction with AED study 411.
- Analysis of 1981/82 samples (not done due to 65% in originally allocated funds). Analysis of 1983 samples (Sediment trap materials and cores), Pb-dating.
- A CONTRACT PERSONNEL (OR SIMILAR) FOR SIX MONTHS TO ASSIST IN PROCESSING FIELD SAMPLE AND LABORATORY WORK IS IMPERATIVE, (included in O & M cost estimate).
- Data analysis.

ANTICIPATED RESULTS: Preliminary report (inc. recommendations) by March 1984.

Final report (1982-84) on Algonquin work by end of 1984.

PROJECT NUMBER: 425

SUBJECT CODE: 8.0

TITLE: International Memorandum of Intent Activities (Project G2.1)

PRINCIPAL INVESTIGATOR'S NAME: G. E. Bangay

AGENCY AND DEPARTMENT: Lands Directorate, Environment Canada

ADDRESS: P.O. Box 5050
Burlington, Ontario

PHONE: (416) 637-4551

COOPERATING AGENCIES AND INVESTIGATORS: Env. Cons. Service

DURATION OF EACH PHASE:

APPROXIMATE COST: Proposed $19,000 O & M and $1.0 P/Y (1983-84)

OBJECTIVES: To support the research initiatives in support of an International Memorandum of Intent on LRTAP with the USA.

To provide chairman to MOI Work Group I.

METHOD:

ANTICIPATED RESULTS:

- Production of Phase III Report of MOI Work Group.
- Support meeting of International, Interprovincial and Interdepartmental research groups.

RELEVANCE: Involvements in MOI process through Bangay and various Work Group and Committees continues to place Lands Directorate in a key, unique coordinating and integrating role for the federal LRTAP initiative.

SUBJECT CODE: 8.0

PROJECT NUMBER: 426

TITLE: National Coordination of Lands LRTAP Program (Project G1.4)

PRINCIPAL INVESTIGATOR'S NAME: C. Rubec

AGENCY AND DEPARTMENT: Lands Directorate

ADDRESS: Ottawa, Ontario
K1A 0E7

PHONE: (819) 997-2320

COOPERATING AGENCIES AND INVESTIGATORS: All Lands Units; Western LRTAP Technical Committee; DOE Western & Northern Region

DURATION OF EACH PHASE:

APPROXIMATE COST: Proposed $15,000 (O&M) and 0.5 P/Y 1983-84.

OBJECTIVES: To provide uniformity of project design and implementation between three eastern Lands units.

To provide program review and monitoring to Lands Management and the ECS coordination.

METHOD: To develop new LRTAP initiatives for Lands in Western, Northern, Pacific and Yukon regions.

ANTICIPATED RESULTS: 1) A Western LRTAP Sensitivity Assessment initiative is expected involving ECS regions west of Ontario.

2) A coordinated and fully integrated Lands LRTAP for eastern Canada.

RELEVANCE: Due to the nature of the 1982-83 program, which concentrated on the Ontario region, no major projects were initiated in the Quebec and the Atlantic Regions. The 1983-84 program as proposed will involve development of 2 new projects in these regions providing an integrated set of studies on ecosystem terrestrial sensitivity and modelling. This requires a significant increase in central coordination and program monitoring to ensure information exchange, effective data analysis and timely results.

NUMÉRO DE PROJET: 427

CODE DU SUJET: 8.0

TITRE: Banque de documents sur les pluies acides

NOM DU CHERCHEUR RESPONSABLE: Lucie Brunelle

MINISTÈRE, ORGANISME OU ORGANISME PRIVÉ, SERVICE: Environnement Canada, Direction générale des eaux intérieures, région du Québec

ADRESSE: 2700, boul. Laurier
C.P. 10100
Ste-Foy, Québec
G1V 4H5

TÉLÉPHONE: (418) 694-3921

COLLABORATEUR(S), ORGANISME(S) ET CHERCHEUR(S):

DURÉE DE CHAQUE PHASE: en continu

COÛT APPROXIMATIF:

OBJECTIFS DE TRAVAIL:
- Mettre à la portée du public et des chercheurs toute la documentation scientifique pertinente relative aux pluies acides.
- Classer et cataloguer par auteurs et par sujets toute la documentation de façon à la rendre accessible au plus grand nombre d'usagers possibles.
- Diffuser une bibliographie régulièrement mise à jour.

MÉTHODE DE TRAVAIL: Dépouillement de bibliographies, d'articles, de rapports

a) recherches bibliographies dans les bases de données

b) commander des documents auprès des bibliothèques et des intervenants dans le domaine

c) classement des documents par ordre d'entrée et sujets

d) maintenir à jour un fichier auteurs.

RÉSULTATS PRÉVUS:
- Publication bi-annuelle d'une bibliographie.
- Accès facile à une banque de plus de 700 documents sur les pluies acides.

SUBJECT CODE: 8.0

PROJECT NUMBER: 428

TITLE: A Case Study of Selected Toxic Substances in the Essex Region

PRINCIPAL INVESTIGATOR'S NAME: Marie Sanderson

AGENCY AND DEPARTMENT: Great Lakes Institute

ADDRESS: University of Windsor
Windsor, Ontario

PHONE: (519) 253-4232
Ext. 415

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: Nov. 1, 1982 - Nov. 1, 1985.

APPROXIMATE COST: $804,000

OBJECTIVES: There is a great need for information on toxic substances in the Great Lakes ecosystem, yet a dearth of information concerning them. At the present time, the long range atmospheric transport of acid-producing chemicals is under intensive study in Canada, yet moving in the same air stream are hundreds of chemicals which are deposited with the acid precipitation.

The research here proposed is concerned with four selected toxic substances, the isomers of polychlorinated biphenyls (PCB), octachlorostyrene, lead (Pb) and cadmium (Cd), to identify the sources where possible and to determine the impact on the ecosystem and the economic and social structure of the Essex region.

METHOD: A multidisciplinary case study is proposed to research in depth the following aspects: the concentrations in the atmosphere, the surface loading, both wet and dry, and concentrations in the soil, surface water, ground water and in the biota. The impact section of the study will include a study of the impact of the pollutants on ecosystems, zooplankton, phytoplankton, microbial, terrestrial and crops, on social systems, administrative and political, a cost-benefit analysis, and a study of public awareness and legal implications.

ANTICIPATED RESULTS:

PROJECT NUMBER: 429

SUBJECT CODE: 8.0

TITLE: Literature Review and Analysis of Acid Deposition in the Northwest Territories

PRINCIPAL INVESTIGATOR'S NAME: Dr. Shewchuk, Saskatchewan Research Council

AGENCY AND DEPARTMENT: Science Advisory Board

ADDRESS: Government of the N.W.T. **PHONE:** (403) 873-7592

COOPERATING AGENCIES AND INVESTIGATORS: Department of Renewable Resources
Government of the NWT

DURATION OF EACH PHASE:

APPROXIMATE COST: $15K

OBJECTIVES:
- to assess the potential for impact of acid deposition on the NWT, and identify shortcomings in the data base.

METHOD:
- the contractor will review available published literature as well as the less accessible government documents.
- identify what is currently known. He will then note data shortcomings and recommend if necessary, procedures to rectify these gaps.

ANTICIPATED RESULTS: After reviewing the report, the Science Advisory Board may recommend to the Government of the Northwest Territories those steps it considers most appropriate.

SUBJECT CODE: 8.0

PROJECT NUMBER: 430

TITLE: An Annotated Bibliography and Assessment of Limnological Studies from Nova Scotia

PRINCIPAL INVESTIGATOR'S NAME: Ms. Patricia Hinch, J. K. Underwood

AGENCY AND DEPARTMENT: Nova Scotia Department of the Environment

ADDRESS: P.O. Box 2107
Halifax, Nova Scotia
B3J 3B7

PHONE: (902) 424-5300

COOPERATING AGENCIES AND INVESTIGATORS: H. Vaughan, Nova Scotia Department of the Environment

DURATION OF EACH PHASE: 2/82 - 12/82 - annotated bibliography
1/83 - 9/83 - isopleth maps, interpretation

APPROXIMATE COST:

OBJECTIVES: Production of a document containing:

- Abstracts, methods of analysis, results and appropriate comments on studies of N.S. lakes relevant to LRTAP.
- Detailed chemical results from computerized data base.
- Cross-index according to author, lake name and location.
- Isopleth maps of various chemical parameters and, where possible parameters at different times (e.g. 1971 vs. present).
- An interpretive report.

METHOD:

ANTICIPATED RESULTS: An overdue and useful synthesis of data on lakes in the province. The Bibliography itself is not selective on quality of data - *caveat emptor*.

PROJECT NUMBER: 431

SUBJECT CODE: 8.0

TITLE: Satellite Observations of Pollution Episodes

PRINCIPAL INVESTIGATOR'S NAME: Dr. Y. S. Chung

AGENCY AND DEPARTMENT: Atmospheric Environment Service

ADDRESS: 4905 Dufferin Street
Downsview, Ontario
M3H 5T4

PHONE: (416) 667-4980

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: To March 1983.

APPROXIMATE COST: $3.0K

OBJECTIVES: To select visual examples of LRTAP from satellite imagery records.

METHOD: Using satellite photographs, selection of pollution episode cases will be carried out. Data gathering and numerical analyses of selected cases will be undertaken. Evidence of LRTAP will be documented and interpretation of the events provided.

ANTICIPATED RESULTS: A report outlining specific cases and physical interpretation.

SUBJECT CODE: 8.0

PROJECT NUMBER: 432

TITLE: Liaison, Coordination and Review of Atmospheric Component (AES) of DOE LRTAP Scientific Program

PRINCIPAL INVESTIGATOR'S NAME: Dr. D. M. Whelpdale, Dr. K. Puckett, E. E. Wilson

AGENCY AND DEPARTMENT: Atmospheric Environment Service

ADDRESS: 4905 Dufferin Street
Downsview, Ontario
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PHONE: (416) 667-4903
-4797

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: Ongoing

APPROXIMATE COST: $10.6K 82/83

OBJECTIVES: To plan, coordinate and review the atmospheric portion of the Canadian LRTAP program. To coordinate AES LRTAP activities with European, USA and Provincial research.

METHOD:

a) plan and review atmospheric program with AES and DOE.

b) coordinate atmospheric programs with other agencies in Canada and in other countries
   - provide a link between AES LRTAP activities and those in ECE/EMEP.
   - coordinate US, Canadian and Provincial LRTAP activities through Atmospheric Subgroup of LRTAP Research and Monitoring Coordinating Committee (RMCC).

c) provide regular reports to LRTAP program and DOE management.

d) provide information on and from the atmospheric program to other program components and users.

ANTICIPATED RESULTS:

a) technical and program briefings,
b) scientific reports and papers,
c) status reports.

PROJECT NUMBER: 433

SUBJECT CODE: 8.0

TITLE: The Feasibility of Using Stable Isotopes for Hydrograph Separation in APIOS

PRINCIPAL INVESTIGATOR'S NAME: U. Sibul, J. Lye

AGENCY AND DEPARTMENT: Ontario Ministry of the Environment, Water Resources Branch, Hydrology & Monitoring Section

ADDRESS: 135 St. Clair Avenue West
Toronto, Ontario
M4V 1P5

PHONE: (416) 965-6995

COOPERATING AGENCIES AND INVESTIGATORS: University of Windsor
M. Sklash

DURATION OF EACH PHASE: 5 months in 1982

APPROXIMATE COST: $30K (1982)

OBJECTIVES: To determine the feasibility of using stable isotopes for separating streamflow hydrographs in the Ontario Calibrated Watersheds into surface and ground-water components.

METHOD: Work will involve surface and ground-water sampling and analysis for O-18, deuterium and tritium. Streamflow hydrograph separations will be made using these isotopes.

ANTICIPATED RESULTS: Conclusions regarding when and where the above techniques may or may not be applicable for hydrograph separation.

SUBJECT CODE: 8.0

PROJECT NUMBER: 434

TITLE: Mapping of Overburden Thickness Using Geophysical Techniques

PRINCIPAL INVESTIGATOR'S NAME: E. Rodrigues

AGENCY AND DEPARTMENT: Ontario Ministry of the Environment, Water Resources Branch, Hydrology & Monitoring Section

ADDRESS: 135 St. Clair Avenue West
Toronto, Ontario
M4V 1P5

PHONE: (416) 965-2105

COOPERATING AGENCIES AND INVESTIGATORS: McQuest Marine Services

DURATION OF EACH PHASE: 2 months in 1982

APPROXIMATE COST: $21K (1982)

OBJECTIVES: To map the total thickness of overburden in specific watersheds of the Calibrated Watersheds in Ontario.

METHOD: A variety of geophysical methods most applicable for the task will be used in the field to determine the total thickness of overburden.

ANTICIPATED RESULTS: Maps of overburden thickness for specified areas at a 1 m contour interval.

PROJECT NUMBER: 435

SUBJECT CODE: 8.0

TITLE: Memorandum of Intent, Work Group 2 (Atmospheric Sciences) Activities

PRINCIPAL INVESTIGATOR'S NAME: Dr. J.W.S. Young

AGENCY AND DEPARTMENT: Atmospheric Environment Service

ADDRESS: 4905 Dufferin Street
Downsview, Ontario
M3H 5T4

PHONE: (416) 667-4610

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: Ongoing

APPROXIMATE COST: $20.2K 82/83

OBJECTIVES: To provide on-going and follow-up support to the negotiation process of a CANADA/USA Transboundary Air Pollution Treaty.

METHOD: Support negotiating team and complete MOI Phase 3 reports:

- advise AES, DOE management and negotiating team on control strategies,
- provide camera ready copies of WG2 final reports,
- coordinate scientific results and ensure Canadian LRT model results required to support negotiations are produced in a timely manner,
- provide technical secretarial function.

ANTICIPATED RESULTS: A signed transboundary air pollution treaty with U.S.A. and a follow-up mechanism in place for the atmospheric component.

CODE DU SUJET: 8.0

NUMÉRO DE PROJET: 436

TITRE: Présidence du Comité régional sur le TGDPA

NOM DU CHERCHEUR RESPONSABLE: Richard Gilbert

MINISTÈRE, ORGANISME OU ORGANISME PRIVÉ, SERVICE: Service de l'environnement atmosphérique, Région du Québec

ADRESSE: 100, boul. Alexis Nihon
Ville St-Laurent, Québec
H4M 2N8

TÉLÉPHONE: (514) 333-3020

COLLABORATEUR(S), ORGANISME(S) ET CHERCHEUR(S):

DURÉE DE CHAQUE PHASE:

COÛT APPROXIMATIF: $1K

OBJECTIFS DE TRAVAIL: Assurer la coordination des activités des différentes composantes du Ministère au Québec dans le domaine du TGDPA.

MÉTHODE DE TRAVAIL: Par le biais du rôle de président du Comité scientifique régional, initier et coordonner certaines activités impliquant les différentes composantes du Ministère au Québec. Exemple d'activités possibles:

- préparation de plans d'action à court terme,
- information du public,
- préparation d'un inventaire des activités réalisées à date,
- préparation d'un document identifiant les impacts connus,
- élaboration d'activités conjointes,
- suggestion d'activités ministérielles dans certains domaines ou dossiers.

RÉSULTATS PRÉVUS: Une présence accrue du Ministère au Québec dans le domaine, une meilleure coordination et de meilleurs moyens de communication entre les intervenants.

PROJECT NUMBER: 437

SUBJECT CODE: 8.0

TITLE: Atlantic Region LRTAP Scientific Program - Liaison, Coordination and Review

PRINCIPAL INVESTIGATOR'S NAME: A.D.J. O'Neill; B. L. Taylor

AGENCY AND DEPARTMENT: Atmospheric Environment Service, Atlantic Region

ADDRESS: Field Services Directorate
Halifax, Nova Scotia

PHONE: (902) 835-9529

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: Ongoing

APPROXIMATE COST:

OBJECTIVES: To coordinate Atlantic Region LRTAP activities.

METHOD:

1. Plans, organizes and implements fall LRTAP workshops for federal, provincial and university representatives working in LRTAP monitoring and effects.
2. Prepares DOE Atlantic Region LRTAP Program Plan.
3. Participates on various LRTAP committees including Atlantic Region Monitoring and Effects Working Group (Chairman), RMCC Atmospheric Subgroup, and Kejimkujik Watershed Coordinating Committee.

ANTICIPATED RESULTS: Coordinated Atlantic Region LRTAP program.
Regular reports including an annual program plan, workshop proceedings and project progress reports.

SUBJECT CODE: 8.0

PROJECT NUMBER: 438

TITLE: Ground Water Leaching Characteristics of Particulate Emissions from Coal-Fired Generating Stations

PRINCIPAL INVESTIGATOR'S NAME: Dr. David W. Smith

AGENCY AND DEPARTMENT: Saskatchewan Power Corporation, Research and Development Centre

ADDRESS: Director, Coal and Gas Research
Research and Development Centre
Saskatchewan Power Corporation
2025 Victoria Avenue
Regina, Saskatchewan
S4P 0S1

PHONE: (306) 566-2287

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: Initiated in 1982, ongoing.

APPROXIMATE COST: Not available

OBJECTIVES:

(a) To monitor the current literature on leaching characteristics of coal ash emission.

(b) To evaluate experimental techniques for leachate analysis.

(c) To study leaching characteristics of ash emitted from SPC generating stations.

(d) To develop methods for minimizing leachability of materials known to be detrimental to the environment.

METHOD:

(a) The literature will be reviewed for studies of the leaching characteristics of coal ashes. Special attention will be paid to reports concerning lignite ash leaching.

(b) As new methods of analyzing for ash leachates are developed, they will be evaluated for their applicability to SPC coal ashes.

(c) The presence, in ground water, of materials originating from SPC coal ash will be tested for by methods deemed appropriate from (b).

(d) If undesirable materials are found to be leached from SPC coal ash then studies will be carried out on methods for treating ash before it can interact with the ground water.

ANTICIPATED RESULTS:

PROJECT NUMBER: 439

SUBJECT CODE: 8.0

TITLE: LRTAP Liaison Office - Federal LRTAP Scientific Program Office

PRINCIPAL INVESTIGATOR'S NAME: Dr. Hans C. Martin

AGENCY AND DEPARTMENT: Environment Canada

ADDRESS: Atmospheric Environment Service
4905 Dufferin Street
Downsview, Ontario
M3H 5T4

PHONE: (416) 667-4803
-4885
-4827

COOPERATING AGENCIES AND INVESTIGATORS:

DURATION OF EACH PHASE: Throughout the duration of the Federal LRTAP Program

APPROXIMATE COST: $75.9K per year, 5 PY

OBJECTIVES: To provide the scientific coordination of the Federal LRTAP/Acid Rain Program and to ensure liaison with the U.S. and Provincial Research Programs.

METHOD: Provide advice and guidance to senior government officials on overall policy matters related to the federal LRTAP program.

Coordinate overall program reviews and evaluations, and make recommendations on future directions.

Arrange and provide the secretariat for the ILC, WLCC, RMCC and RMCC-NAPAP meetings.

Chair ILC Scientific Sub-committee meetings.

Provide interpretive reports and briefing material on the scientific and financial aspects of the Federal LRTAP Program.

ANTICIPATED RESULTS: A well-coordinated Federal LRTAP Scientific Program!

APPENDIX

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